SCIENTIFIC AMERICAN

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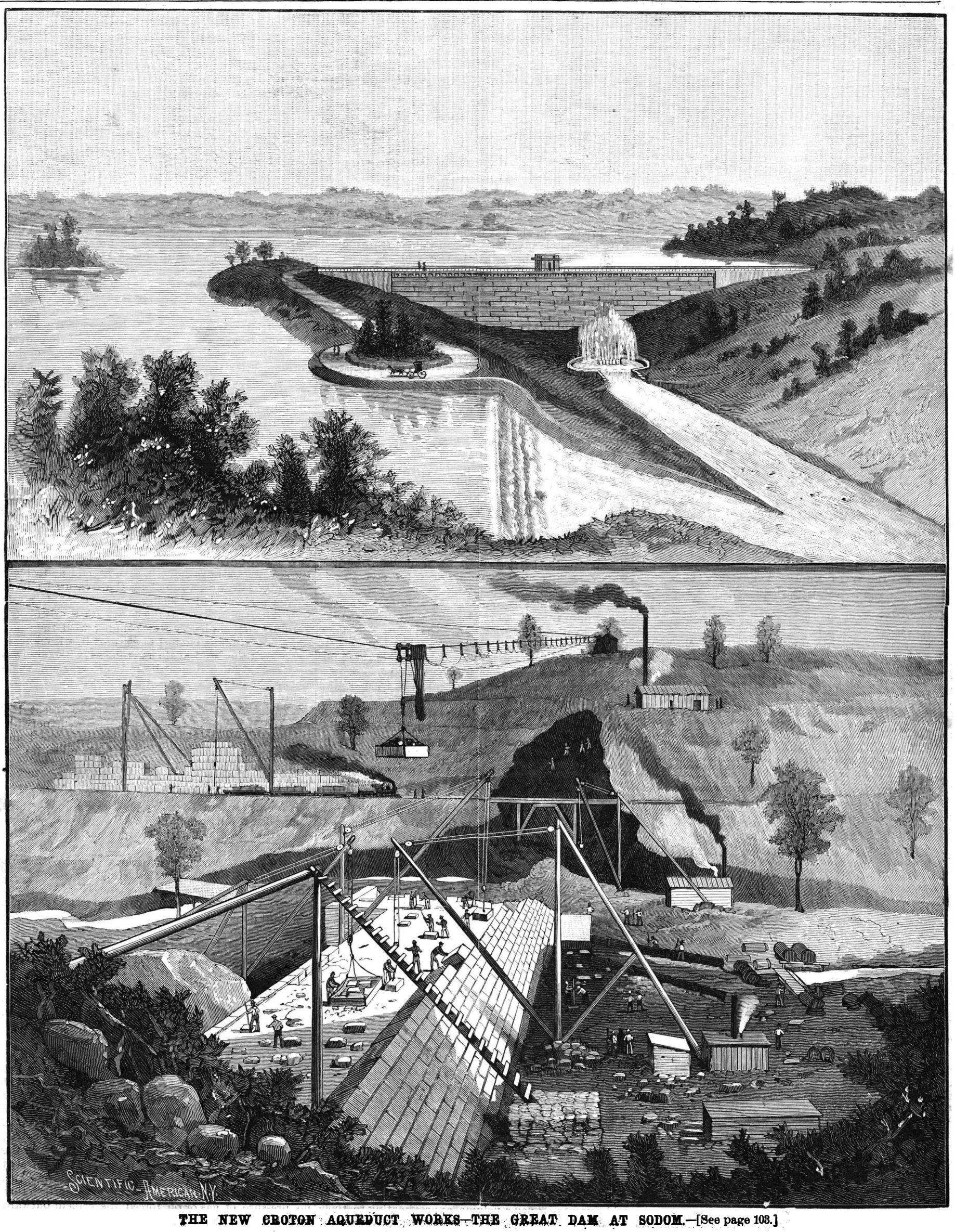

THE NEW CROTON AQUEDUCT WORKS—THE GREAT DAM AT SODOM.—[See page 103.]

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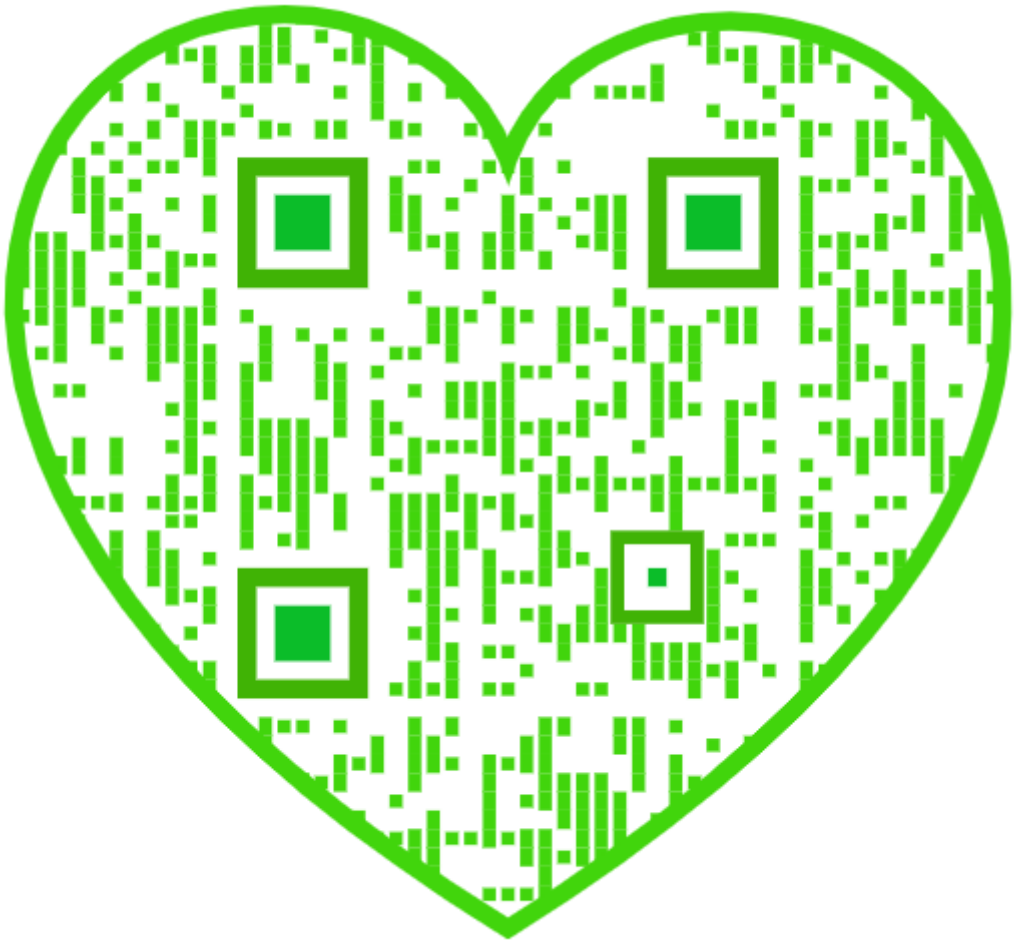

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A RECENT SEARCH LIGHT EXPERIMENT.

The recent experiments with electrical search lights on the Spit, near Hurst Castle, opposite the Needles passage, in the Solent, England, were, so far as can be learned, not in anywise novel, nor is it easy to see how, as is claimed in some quarters, these lights can balk torpedo boat attack. The design was to protect the roadstead, and it is claimed that this was accomplished. It is true that the torpedo boats were discovered in the blackness and held in broad view for the fire of the shore batteries. Perhaps these batteries could have destroyed them before they reached the shipping, perhaps not. Even if so, it does not prove very much.

An account says that a great volume of smoke made by the war ships accompanying the little craft, purposely to mask their design, blew out to sea, the wind being outward, thus enabling the search lights to bring the enemy out clear. But the wind does not always blow in that direction, and hence the test would have been more satisfactory had the wind favored the attack.

Again, the best promise of the torpedo boat is thought to be in the protection of, rather than in the attack upon, harbors. Electrical search lights might or they might not advantage ships coming in from the sea. Supposing they did locate the attacking torpedo boats as they came up; unless there was the power to beat them off, of what value would the knowledge be? If the heavy quick-firing guns now being set up atop the conning towers of the new torpedo boats realize the promises made for them, the torpedo boat will have a palpable advantage, because able to throw upon a ship as heavy shot as can be thrown back, before it an immense target and a steady one, though itself affording only a small and running mark for the ship's gunners stationed aloft and alow.

THE INADEQUATE SUPPLY OF WATER FOR NEW YORK.

For complete physical independence there are few undertakings that will compare favorably with the new Croton scheme. Tested by any one of several elementary methods, it departs so widely from the requirements that the results only corroborate the hypothesis that the scheme claims absolute freedom from all obligations of physical science.

Take, for instance, the relation that should exist between the capacity of the aqueducts and the available supply. So far as any advantages of storage are concerned, the surveys explain that, owing to the topography of the 361 square miles constituting the basin, there is an area of 115 square miles in the lower part of the valley that cannot be made to contribute to reservoirs except a terminal one be provided, and therefore this portion may be deducted from the whole, leaving the available area for storage 246 square miles.

Speaking generally, one square mile of watershed will supply from 13,000 to 15,000 persons, provided the allotment is only fifty gallons. Now, since New York needs one hundred gallons per capita, it is plain that one square mile of the Croton basin will only supply half this number, or from 6,500 to 7,500 persons. Estimating the population at present to be 1,700,000, the number of persons depending on each square mile of watershed (omitting the inhabitants thereof) is about 7,000. But to furnish this population with water during the present summer, it is computed that 23 thousand million gallons of storage would be necessary; and inasmuch as the storage provided amounts scarcely to 9 thousand million gallons, there is a deficiency of 14 thousand million gallons.

This volume of storage (nine thousand million gallons) is what is necessary to furnish 100 million gallons per day—the capacity of the old aqueduct.

Can it be that the completed aqueduct is not "turned on" because it would now bring no greater volume of water to the city than the old one?

When the Sodom dam is completed, say in 1893, the storage will be increased, but the city also will have increased to such an extent that the deficiency of storage will then be 16 thousand million gallons. In case the new aqueduct is courageously put into use by the summer of 1893, the total aqueduct capacity will then be 350 million gallons per day, while the volume furnished by the reservoirs will be 135 million gallons.

Will the deficiency be made up in 1897? By this time the demand of the city will have reached 250 million gallons per day, and the storage computed to be necessary is 43 thousand million gallons. Now, the maximum storage capacity of the Croton basin, without the Quaker Bridge dam, is 20 thousand million gallons; and since it is practically out of the question to finish this latter structure before the year cited, there will then be a deficiency of 23 thousand million gallons, and more, too, unless all the smaller reservoirs are completed in the interval, which is so improbable that it is safe to assert that the two aqueducts together will not convey in the dry season of 1897 more than 140 million gallons per day.

Now the question arises, Will the aqueducts even in mid-summer convey a volume approximating to their capacity? According to the meteorological record of the Croton Aqueduct Department, the maximum volume of water obtainable is 270 million gallons per day (80 million gallons less than the aqueducts can deliver); and since the city will need this volume during or before the year 1899, it is certain that even if the projected dams are then in service, the deficiency of storage would only be made up for a brief season.

To state the whole matter in a different way, we might say that during the next ten summers sixty per cent of the joint capacity of the aqueducts cannot be utilized. What can be the gain in adding to the expenditure in this drainage area, when the greatest possible effort can only remedy the present deficiency ten years in the future, and then only for a short period?

The conclusion is unavoidable that the Croton basin was too limited to warrant the construction of the second aqueduct, and does not warrant the construction of more dams now—hence the scheme's independence of surveys and records of rainfall.

If all future expenditure be devoted to bringing water from an elevated watershed that will afford 500 million gallons daily, the deficiency existing to-day can be made good in five years, the pressure can be restored, and the quality of the supply improved.

SPEED TRIALS OF A BRITISH SQUADRON.

The British Mediterranean squadron recently had a four hours' trial of speed between Cagliari and Port Mahon, the result showing that, in a seaway only fairly heavy, an enemy's mercantile traffickers, if ordinarily fast steamers or even sailers—for a quick-heeled sailing craft with a gale behind her is good for 15 knots—have little to fear from any ship now in the Mediterranean squadron, and any craft purporting to be a warsman not fast enough to distance it nor armored to stand and fight would scarce deserve a better fate than to fall a prey.

The trial was under the British Admiralty orders that squadrons must try the speed of their ships quarterly, the day being set long in advance, so that nothing better than ordinary condition of wind and sea may be expected. The wind was a head one, what there was of it, a "moderate" swell running. Here is the tally of the four hours' run, the measure being in knots: Benbow, 61·5; Scout, 58; Phaeton, 57; Colossus, 56·5; Edinburgh, 51; Temeraire, 50·5; Dreadnaught, 48. From this it will be seen that the best time made was the Benbow's, averaging scarcely 15·4 knots an hour, the others in their order averaging 14·5, 14·2, 14·1, 12·7, 12·6, 12·0.

When the speed of these several ships is compared with what they are credited with upon the measured mile, the disparity is wide—further evidence, surely, that practical tests, under ordinary conditions, are the only ones worth the care and expense of making. If the sea were always smooth, save at odd and widely separated intervals, a run along the measured mile or along the channel of a sheltered river would be a fair test. But the contrary is the case. It's nearly always rough, sometimes heavy seas running with the wind, sometimes running against or athwart it, with a nasty swash resulting, and again swelling as with subterranean convulsion. Hence the measure of a ship's efficiency should be on the broad seas in ordinary weather.

A curious and interesting feature of the recent test was the behavior of the Temeraire, which, notwithstanding her aged boilers and lofty spars, she being ship-rigged, ate into the head wind, fairly up with most of the more modern craft, though they were without tophamper, indeed, beating one of their number, the Dreadnaught, for which so much had been promised.

It is only a natural inquiry how such ships as those composing this squadron could destroy an enemy's commerce that should be carried in steamers like the City of Paris, the new Hamburg-American steamer Columbia, the City of New York, Augusta Victoria, Etruria, Umbria, and many more that could be mentioned? How could they prevent the commerce of their own country from being destroyed by these swift craft, a few light guns being mounted on their main decks?

A New Joint-Making Material.

A permanent and durable joint can, it is said, be made between rough cast iron surfaces by the use of mineral asbestos mixed with sufficient white lead to make a very stiff putty. This will resist any amount of heat, and is unaffected by steam or water. It has been employed for mending or closing cracks in cast iron retorts used in the distillation of oil and gas from cannel coal. The heat being applied to the bottom of retorts, and the temperature of the iron maintained at a bright red heat, after a time the bottom of the retort would give way, the larger portion of the crack being downward toward the fire. The method employed was to prepare the mixture, and place it on the top of a brick, then put the brick on a bar of iron or shovel, and press the cement upward to fill the crack in the iron, holding it for some time until it had penetrated the cavity and somewhat set. Of course, during this operation, the lid was removed from the retort, so that no pressure of gas or oil forced the cement outward until set.

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CONSTRUCTION OF NEW RESERVOIRS FOR NEW YORK WATER SUPPLY.

Very few are aware of the magnitude and nature of the work that is being carried on with a view to improving the water supply of New York City. Ever since the late public examination into the aqueduct contracts and into their proper, or rather improper, fulfillment, public interest in this great engineering work appears to have flagged. Even the daily press, which at that time was filled with leaders on what they deemed a public scandal, has lapsed into silence, and little is ever heard of the present condition of this work. It is possible that the very rainy seasons of this and last summer have been the cause of this public indifference to our present inadequate water supply. Whether the problem will be solved by the methods proposed or not, from an engineering point of view the work possesses great interest, and the description on another page shows how far the work has progressed. The work we allude to is the construction of two dams on the Croton River, which serve to furnish two large reserve reservoirs to be called into service in case of the failure of Croton Lake. The map on page 103 shows the geographical situation of these dams. These bodies of water will be known as Sodam dam reservoir and Bog Brook reservoir. Collectively they will have an estimated capacity of 9,000,000,000 gallons, or nearly four and one-half times the capacity of the present Croton reservoir.

As will be seen by examining the map on page 103, the amount of work that has been finished and that is in course of completion is very small in comparison with the vast bodies of water that will eventually be stored for the use of this metropolis. Nothing has yet been done to Quaker Brigde dam, and the opposition that has been offered to its construction has been so great that other points on Croton River have been examined in regard to their availability. Borings have been made at four places between Croton dam and the proposed site of the Quaker Bridge dam, and it is possible that some new and definite plan will be proposed before many months.

In case the borings show that a rock bed can be reached at a less depth, it is probable that such a site would be preferred to the Quaker Bridge, even though it were necessary to construct a dam of greater length; and surveys are now being conducted at several points of the river where the banks are farther removed from one another to decide upon this question. We purpose in an early issue to follow this article on the Sodom dam by an article on the present condition of work at an interesting point of the new aqueduct.

[SPECIAL CORRESPONDENCE OF THE SCIENTIFIC AMERICAN.]

The Paris Exhibition.

THE WOODWORKING MACHINERY.

PARIS, August 1, 1889.

American woodworking machinery is conceded even by its European competitors to be surpassed by none, and there is no doubt that most of the new improvements and applications in this class of machinery not only originate, but have to be developed, in the United States before they are copied on this side. George Richards, of Manchester, has done a good deal toward showing in England the advantages of some American designs, and of course this has been an uphill fight, as pioneer work always is, the Baxter D. Whitney scraping machine being a prominent example. There is no European equivalent of this machine. Mr. Whitney, by the way, brought over, on his recent visit with the American joint engineering societies, two exceedingly interesting pieces of work. One is a sample of wood planing consisting of a piece of stuff about ¾ inch planed down to a thickness of about 1-100 inch, with a clean and almost polished surface, and it is conceded on all hands to be a matchless piece of work. The other is a right and left hand screw, upon which I propose to have something to say at a future time. Speaking of samples of woodworking reminds me that in some of the large woodworking machine manufactories in England I have seen samples of woodworking that came from the United States and that were used to show what certain classes of machines could do.

The principal exhibit of woodworking machinery is that of J. A. Fay & Co., of Cincinnati, Ohio, and a very fine exhibit it certainly is for quality as well as quantity, while it is thoroughly representative of advanced American practice.

Beginning with the No. 4½ heavy, four-side, patent moulding machine, we have here a solid, substantial machine, mechanical-looking in every detail, and remarkable for the ease and rapidity with which it can be handled when at work and adjusted for different kinds of work. There are two feed rollers above and one below the platen, the upper one nearest the cutter head being small in diameter, so as to bring it as near as possible to the knives. The lower feed roll, on the other hand, is of very large diameter, and runs in adjustable bearings. The upper feed rolls are carried in swinging yokes, so that, while they always rise parallel with the stuff being worked, yet they can be swung out of the way in an instant to get at the cutters. There is a wood pressure shoe both back and front of the cutter head.

The two side heads and the under head are carried with their bed, so that when these heads are once adjusted, the bed may be raised or lowered for different thicknesses of stuff without disturbing their adjustment. The two side heads may be adjusted vertically and set to any required angle up to 45° and may be adjusted laterally to suit the width of the stuff or of the work. The lower cutter head has an end adjustment and is carried on the same bed as the side heads, so that when these three heads are adjusted, the bed may be raised or lowered at will without altering their adjustment. The opening in the bed for the lower head has movable plates to adjust the width of aperture to suit the depth of cut or the size of the cutter heads.

The upper cutter is furnished with an outside bearing that is a great improvement for fine work, as it steadies the head and prevents vibration.

We now come to a distinguished feature of the machine, namely, its convenience of handling. The handwheel for raising or lowering the platen, the checking lever for securing it in its adjusted position, the lever for starting and stopping the feed, the wheel for adjusting the height of the side heads, and the bolt for setting them to an angle, the handles for their lateral movement, and the wheel for the end adjustment of the lower head are all on one side of the machine and within easy reach of the operator, as he stands in his natural position at the machine with the work going on before him.

The next machine to claim attention is the No. 5 patent band resawing machine, and this brings to mind the curious fact that, while the French are the inventors of the band saw, it is in the United States that band sawing machines have been brought to the highest state of perfection, indeed the reciprocating frame saws so much found in the Arbey practice and in England cannot compete in the United States with the self-feed resawing machine.

The machine before us is a combination one, inasmuch as that the table carrying the roll feed mechanism may be turned upside down, taking the feed rolls, etc., entirely out of the way and leaving the machine a plain band sawing, but the solidity and usefulness of the machine is in no way sacrificed to obtain this double service. The machine is designed for reducing deals to lumber or resawing boards to thin stuff, as for panels, picture backing, or splitting veneered panels. The saw is but 20 gauge, producing a kerf of less than one-sixteenth inch. Some of the work I saw produced on this machine in the exhibition was less than one-sixteenth thick and as parallel as could be. All four of the feed rollers are driven both sides, being adjustable to or from each other, while one pair of rollers is made yielding, to keep the feed pressure constant, notwithstanding inequalities in the lumber or stuff. The rate of feed is regulated by a friction disk, which can be adjusted without stopping the machine to give any rate of feed from 5 to 40 feet per minute.

Next may be noticed the improved miter and bevel saw table. This class of machine finds increasing favor every year, doing much of the work formerly assigned to the band saw. The fact is that setting a band saw table out of the horizontal for bevel work makes it very troublesome to handle the work, and this machine gets over that difficulty by using a circular saw so mounted beneath a fixed horizontal table that, while it will swing 45° out of the vertical, yet the opening through the table is no wider than it would be if the saw ran in a vertical plane only. The adjustment of the saw either for height or angle can be made while the machine is still or running. Suitable fences and gauges of course accompany the machine. We now come to a self-feed rip saw in which a serrated feed wheel no thicker than the circular saw, and set in line with it, is used. This class of machine finds much favor on account of its simplicity for a self-feeding machine. The table is fixed, the saw raising and lowering through it for adjustment to the work. A simple train of gearing that is covered in drives the feed wheel, and a spring guard covers the saw and holds the end work in place, so that it shall glide smoothly along as it leaves the saw and not catch. A suitable fence having a parallel motion is provided, all the handles for working the machine being conveniently situated within reach of the operator.

The most important machine in the whole of this exhibit is perhaps the patent lightning flooring machine, which possesses some interesting and novel features. To begin with, the machine is exceedingly well proportioned throughout. It looks stiff and substantial without being ponderous, while the workmanship is much better than is usually bestowed upon woodworking machinery (a fact, however, that applies to this whole exhibit.)

The machine beads as well as cutting the sides and edges or matching, and some of its notable features are as follows: In addition to the ordinary feed rolls, there is a feed roll revolving in a horizontal plane, and therefore giving an edge feed to the board while keeping it up to the fence—a valuable feature. Then the fences for all the beads move simultaneously and equally (a feature of special merit). The side beads either adjust together or independently, as may be required, carrying their gauges with them. All parts of the machine are easily got at for adjustment, etc., and the handles, etc., for operating it are conveniently got at, handiness having been carefully thought out.

There are two tenoning machines in the exhibit (both suitable for heavy work, but one larger than the other), one having a hand feed only, and the other an automatic feed as well. The latter is a gap machine, which increases its capacity and enables it to serve for gaining purposes. The top and bottom head are adjustable either independently or simultaneously on their vertical slides, the top spindle being carried in a gateway or slide that enables it to be adjustable endways. The power feed is operated by cone friction disks, the carriage running on friction rolls.

The lower head is lowered out of the way when gaining is to be done, the gaining heads going on the top arbor, and being capable of expansion to double its normal capacity. Thus a three inch head will make a gain anywhere from 3 to 6 inches wide, and so on for all sizes.

A cabinet maker's double circular sawing machine exhibited has two saws (one a rip and the other a cross cut) on independent spindles, one iron table serving for the two. There is a space between the two saws, however, that can be thrown back to allow free access to the saws. Either saw can be replaced by heads for rabbeting, gaining, dado work, or plowing. The table on the up saw side is fitted with an adjustable fence which can be set to any required angle and is movable in planed ways to or from the saw. On the cross cut side a cutting-off slide is provided with suitable stops for cutting off to length and adjustable to various angles. T slots for miter or cutting-off slides are provided for each saw.

In thé Strifflers patent double cut-off sawing machine four saws are provided, two being in a table fixed at one end of the frame and two in a table adjustable along the frame, but which may be instantly locked in its adjusted position. Each table has one arbor which carries a saw on each end and is in a frame which is raised and lowered by a hand wheel in front. Wood packing plates are inserted in the tables around the saws, which can be removed for grooving purposes. The machine will cut off to exact length anything from 6 inches to 6 feet long, the sliding cross cut gauge being provided with stops (for cutting to exact length), and so arranged that one operator can work with the grooving saw and another cut off both ends of the work at once to any length from 22 inches to 5 feet without using any sliding carriages. In a No. 2 patent automatic railway cutting-off saw machine in this exhibit the saw is traversed back and forth by a chain feed put in operation by a foot lever. The guide rails for the traveling carriage are cast solid on the frame to secure rigidity. Adjustable stops regulate the distance the saw travels. The feed motion of this machine is very simple and ingenious, the foot lever that governs it serving to cause the table to traverse in either direction, and when uninfluenced by the operator's foot, throwing the feed out altogether. The cutting-off machine part of the exhibit is completed by a vertical cutting-off and mitering machine, in which the saw carriage is operated on a vertical slide, the feed screw being operated in either direction by three bevel friction wheels at the base of the machine, a single treadle being so constructed that it will throw the clutch to the right or left, according as the saw is required to travel up or down. A stop motion for the limit of descent is provided by a rod from the carriage to the treadle rod, which throws the clutch out of gear when the saw has descended or ascended to the required distance. The notice of this exhibit may be concluded for the present with the planer knife grinding machine, in which the end face of a hollow cylindrical emery wheel is used for the grinding. The table traverses automatically to a determinate point, and continuously without attendance after the machine has once been adjusted, a stop motion causing the grinding operation to cease when sufficient has been ground off to resharpen the knife. If it be desired to grind the knife concave, the head carrying the knife swivels, by which means the amount of concavity may be varied at will within certain limits. It may be noted that concave grinding is less in vogue than formerly, as, being very thin or not well backed up by metal behind it, it is tremulous and does not produce smooth work.

JOSHUA ROSE.

Utilization of Running Streams.

The utilization of running streams is the object of many recent devices, among which may be mentioned that of M. Tayn, a Russian engineer. His apparatus consists of an endless cable, carrying a series of canvas cones, which open and shut like an umbrella. The cable passes over a double drum on board a pontoon, and at the other end over a pulley suspended from a buoy. On the lower part of the rope the cones are opened and forced forward by the current of water, thus setting in motion a shaft or drum.

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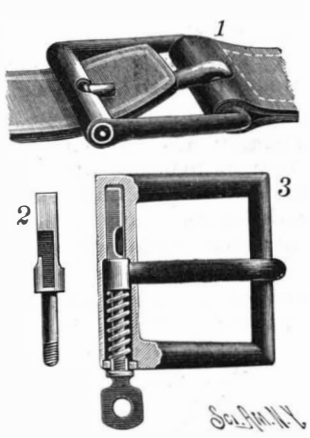
AN IMPROVED UMBRELLA STAND.

A device whereby a number of umbrellas may be rigidly held in such position as to present an attractive appearance is shown herewith, and has been patented by Mr. Jonathan Haight, of Pittsfield, Mass. The body of the stand has shoulders one above the other, the lowest shoulder being the largest, there being on the inner side of each of these shoulders, next the body of the stand, a V-shaped groove, in the bottom of which is a series of cavities, each adapted to receive the ferrule of an umbrella. To each of the shoulders is attached a disk having a series of essentially oval shaped openings to receive each an umbrella, and give it an inclination upward and outward. In the top of the base of the stand vertical rollers are arranged upon a concentric line, the rollers being countersunk in the base in such manner that they will project but slightly above it, whereby the stand may be revolved and the umbrellas made to face in any given direction.

HAIGHT'S UMBRELLA STAND.

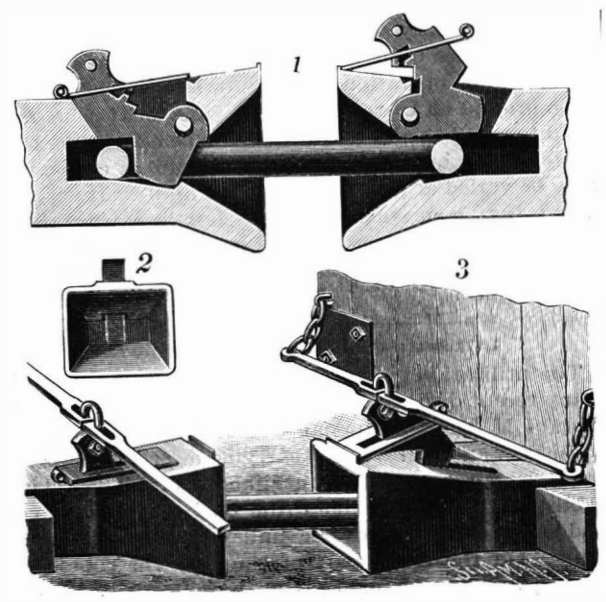
AN IMPROVED LOCKING BUCKLE.

A buckle in which the tongue is positively locked against the buckle frame is shown in the accompanying illustration, and has been patented by Mr. William Blum, of Newark, New Jersey. Figure 3 is a plan view of the buckle and its key, partly in section, Figure 2 being a side view of the locking bar detached, and Figure 1 a perspective. The front bar of the buckle frame is hollow and centrally notched for the entrance of the point of the tongue. Within the front bar is fitted a spring-actuated locking bar, angular at its inner end to prevent its turning, and threaded on its other rounded end to receive an internally threaded key, for partly withdrawing the locking bar against the tension of a spring coiled around it. Just beyond its center the locking bar is notched, and a longitudinal slot extends toward the center from the bottom of this notch for locking the tongue. The key is used to move the locking bar outward until its notch registers with the notch in the front bar of the buckle frame, and, when the key is removed, the spring pushes the locking bar inward, so that the notches are out of register, preventing the withdrawal of the tongue except by the use of the key.



AN IMPROVED CAR COUPLING.

An automatic car coupling in which a pivoted pin or dog is employed to engage the coupling link and hold it in position in the drawhead, and in which the parts will always be in a position for automatic coupling after the cars have been uncoupled, is illustrated herewith, and has been patented by Mr. Charles W. Chisholm, of No. 11 Patrick Street, Winnipeg, Manitoba, Canada. Fig. 1 shows a central longitudinal sectional view of the device as applied, Fig. 3 being a perspective, and Fig. 2 an end view of the drawhead. Within a vertical slot in the top of the drawhead a coupling dog is mounted, supported by a pivot passing through an aperture of larger diameter than itself in the dog. When in the coupling position, the lower portion of the dog rests within a recess in the bottom of the drawhead, the rear portion of the lower projection of the dog constituting the bearing face. As the link enters the drawhead, and strikes against the forward inclined face of the dog, the latter is forced to the position shown at the right in Fig. 1, the dog dropping back, when the link has passed in, to the position shown at the left in the same figure. The dog extends somewhat above the top of the drawhead, where it has a handle or lug, connected with a lever extending to each side of the car, by which the dog is manipulated. The dog may be locked in such position that the link may be withdrawn by lifting the dog until a shoulder thereon is brought into engagement with a notch in the top of the drawhead, but as the link is drawn out of the link recess it strikes against a projection of the dog, whereby the latter is returned to the position shown at the left in Fig. 1. A metallic cover is provided to prevent the entrance of gravel, snow, etc., when the parts are in coupling position.



CHISHOLM'S CAR COUPLING.

Medicinal Properties of Vegetables.

The following information may be useful to some at this season of the year, if not new to many:

Spinach has a direct effect upon the kidneys.

The common dandelion, used as greens, is excellent for the same trouble.

Asparagus purges the blood. Celery acts admirably upon the nervous system, and is a cure for rheumatism and neuralgia.

Tomatoes act upon the liver.

Beets and turnips are excellent appetizers.

Lettuce and cucumbers are cooling in their effects upon the system.

Onions, garlic, leeks, olives, and shalots, all of which are similar, possess medicinal virtues of a marked character, stimulating the circulatory system and the consequent increase of the saliva and the gastric juice promoting digestion.

Red onions are an excellent diuretic, and the white ones are recommended to be eaten raw as a remedy for insomnia. They are a tonic and nutritious.

A soup made from onions is regarded by the French as an excellent restorative in debility of the digestive organs.

OPERATIVE DENTISTRY—FILLING TEETH.

Dr. Charles H. Land, of No. 264 Woodward Avenue, Detroit, Michigan, has invented and covered by several patents a means of restoring decayed or imperfect teeth to their original shape, size, and color. The invention provides a method of moulding vitreous or other substance into sections corresponding to the form of the lost portions of decayed teeth, by swaging or burnishing a thin metallic matrix of suitable metal into the cavity of the tooth, and producing with such matrix a solid section or plug of any desired material corresponding to the shape of the cavity in the natural tooth, this plug being fixed in position by suitable cements, either with or without the matrix. The invention also covers the preparation of veneers of all forms and tints, to be kept in stock by dentists, a metallic cover being shaped to the outlines of the tooth to be crowned, the previously prepared porcelain veneer to be fitted to the cover, and fused thereto by an intermediate stratum of porcelain paste.

In Fig. 1 of the illustrations, 1 represents a tooth having a cavity needing filling; 2 and 3 show a matrix fitted to the cavity; 4 shows a filling fitted to the matrix; 5, a complete filling applied in the cavity; 8, another form of cavity in a tooth, and 11, a filling applied thereto; 9, a modification of the metallic mould plate, and 10, a filling fitted thereto; 6, a sectional view, showing the cavity partially filled with a soft filling; and 7, a modification of the matrix and plug for use therewith.

In Fig. 2, 1 represents a typical view of decayed front teeth, and 11 shows them restored; 5 is a single tooth prepared for the fitting of the metallic cover; 6 is a modification, with the tooth built up with amalgam or other suitable substance; 7 shows the metallic cover prepared to fit the tooth, and 9 and 10 are side and perspective views of the porcelain veneer to fit the metallic cover, while 8 shows the metallic cover with the porcelain veneer fused upon it. A tooth prepared for a partial enameled cover is shown in 2, and 3 is a sectional view of a partial enameled cover applied to the tooth, 4 showing the cover separately.

In forming the matrix, platinum is preferably employed, although gold and silver or other material may be thus used, and in some cases pins are engaged with the matrix, porcelain, rubber, or glass, and in some instances metal, such as gold or silver, being used to fill it, although porcelain is preferred. The latter, with certain forms of rubber, may be modified in color to approach the shade of the natural tooth, and will also take a durable polish. The thin piece of platinum plate may be readily swaged into the cavity of a tooth to make a perfect impression, while the porcelain paste built into the matrix may be readily carved or modified to imitate the original contour of the lost portion of the tooth, being then fused in the ordinary manner.

In the use of the previously prepared porcelain veneers, which are made as separate articles of manufacture, expressly for this class of work, a suitable veneer is selected and ground and fitted to its place, when it is engaged upon the metallic cover by using a porcelain body or paste, the cover, veneer, and porcelain body being fused together, the cover with its combined veneer being then cemented upon the tooth.

Dr. Land has also invented what he styles the "Midget" gas blast furnace and blowpipe combined,

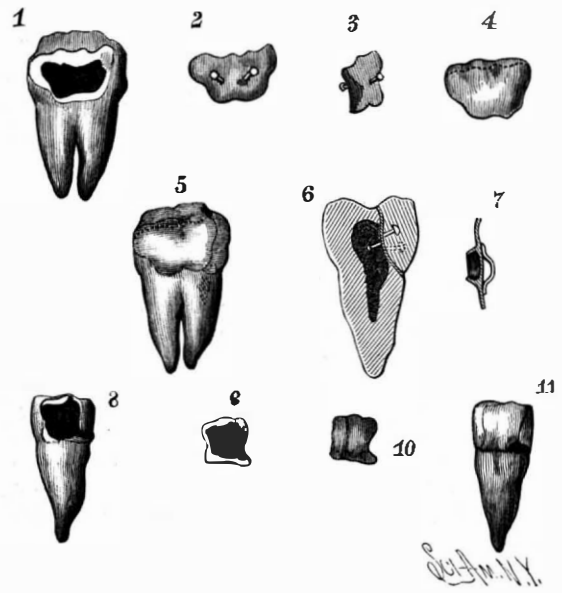


Fig. 1.—RESTORING DECAYED OR IMPERFECT TEETH

as an ideal furnace for the operative dentist, and for especial convenience in the fusing operations required with his porcelain fillings. The furnace complete, with blowpipe, stand, and bellows, does not occupy more than ten inches of space, and by its use the dentist can readily fuse high grade porcelain in from six to fifteen minutes. The Hydrocarbon Furnace Co., of Toronto, Canada, has been organized to introduce this furnace and Dr. Land's other dental inventions in Canada.

Dr. J. A. Robinson, of Jackson, Mich., president of the Michigan Dental Association, writes that "the new method invented by Dr. Land is a step forward in the dental art. It is a new method of the old plan of continuous gum work applied to teeth. We have removed large gold fillings in the front teeth and replaced them with porcelain caps, but the process was long and wearisome to the operator and patient. With Dr. Land's method most of the work is done in the laboratory, when the patient is dismissed until the cap is enameled,

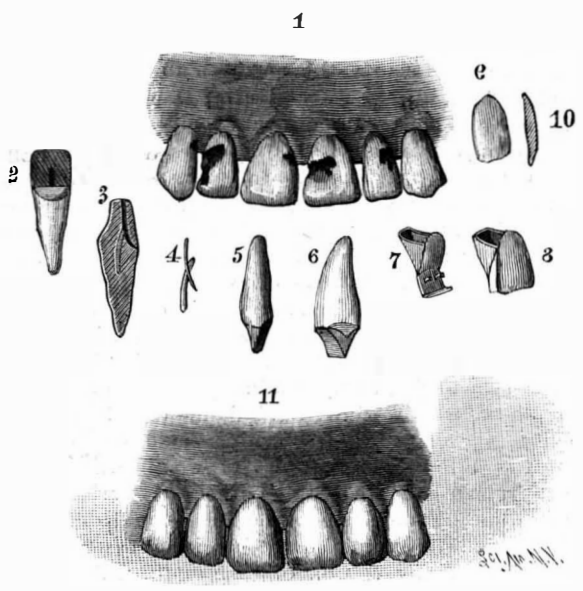


Fig. 2.—RESTORING DECAYED OR IMPERFECT TEETH.

and then it is inserted in a very short time. The great advantage of the new system is the most perfect adaptation and the means brought about to accomplish the result by his new furnace and a series of different colored bodies, matrices, etc., to obtain the exact shape and shade of the natural teeth. These fillings are to take the place of all other fillings, from the smallest filling to the entire crown of the tooth."

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MANUFACTURE OF ROLLED BARS OR RAILS DIRECT FROM THE MOLTEN METAL.

By the method or process heretofore generally in use for manufacturing railroad rails and other metal bars the molten metal is first cast into an ingot, which is then reheated and rolled and rerolled until reduced to the required size and shape. By this method the molten metal is not subjected to compression in the mould while it is in the act of setting, though it is well known to those skilled in the art that the compressing of the molten or setting metal while it is yet in the fluid or setting state tends to greatly improve the character and quality of the steel produced and to give the castings or ingots a very dense, solid, and homogeneous structure; and where, as heretofore, the metal is cast in a closed mould confined on all sides, excepting at the top or runner, air or gases confined in the molten metal have little opportunity to escape, so that it is difficult in this way to produce an ingot entirely free from air holes and imperfections. The rolling and rerolling to shape of the finished bar or rail tends to densify the metal to a greater or less extent; but this rolling operation does not entirely remove the flaws or imperfections produced in the ingot at the time it is cast. The manufacture of metal bars or rails by this old process also involves considerable time, labor, and expense in the several steps of the process, and requires an extensive and costly plant of machinery.

The invention of Edwin Norton and John G. Hodgson, of Maywood, Illinois, consists in pouring a continuous stream of molten metal from a suitable vessel and simultaneously compressing, setting, and shaping the metal by its contact with chilling and compressing surfaces or rolls, which confine or surround the stream on all sides as it passes such continuously-moving chilling surfaces or rolls. The chilling surfaces or rolls which shape, compress, and set the metal, and thus convert the molten stream of metal into a metal bar or rail, travel or move at the same surface speed as the velocity of the flowing stream of molten metal, so that the molten metal will not dam up or collect between the rolls, and so that the molten metal or bar produced will come in contact with the rolls or chilling surfaces only at a single point, so to speak, at a time.

The metal bars or rails, it will be thus seen, are produced directly from the molten metal, and without first casting the metal into an ingot and heating and rolling and rerolling it; and as the molten metal is poured in a continuous, solid stream into what may be termed a continuously revolving or traveling metal chilling and compressing mould, which comes in contact with only one point, or a very limited length of the metal stream or bar at a time, and is continuously traveling in the same direction with the stream or bar, point after point in the whole length of the metal stream or bar coming successively in contact with this traveling or revolving compressing and chilling mould, the metal bars or rails are of course produced in continuous lengths, and the process or operation is continuous so long as the stream of metal flows.

In practice the molten metal is poured in a continuous solid stream, from a suitable bowl or pouring vessel, between a series of rolls, preferably four in number, having their axes arranged in the same horizontal plane and having a pocket or space between their peripheries at their common meeting point for the reception of the stream of molten metal, so that the stream of molten metal, as it passes between the rolls, will be compressed by the wedging action of the rolls and the molten metal at the same time chilled or set by contact with the rolls. The rolls are made hollow and filled with water, which is made to constantly flow through them, so as to keep them cool or at the proper temperature for chilling or setting the stream of molten metal as it flows between the rolls. The pouring bowl or nozzle is arranged directly over the common meeting point of the series of rolls, so that the stream of molten metal will flow in a direction tangential to all the rolls. Each roll thus comes in contact with the stream of molten metal, or with the metal bar produced, only at a single point, so to speak, of its periphery at a time, thus making it practicable to easily keep the rolls cool, or at a proper temperature for chilling or setting the

STATUE OF LEVERRIER BY M. CHAPU.

[FOR DESCRIPTION SEE NEXT PAGE.]

stream of molten metal as it passes between the rolls. The rolls are revolved at a sufficiently great surface speed, in respect to the velocity of the stream of molten metal and in respect to the space between the rolls or the size of the bar being produced, as to prevent the molten metal collecting or damming up in the space between the rolls. Large surface contact between the molten metal and the chilling rolls is thus prevented, which would tend to heat the rolls rapidly and render it difficult to keep them cool or at the proper temperature, on the one hand, and which, on the other hand, would tend to chill or set the molten metal before it reaches the meeting line or plane joining the axes of the rolls, and where the passage between them is most contracted, thus subjecting the apparatus to greater strain and requiring greater force to revolve the rolls, and interfering, to a greater or less extent, with the proper compression of the metal while yet in a molten or setting state.

By employing a series of rolls, the fluid or setting stream of metal passing between the rolls is compressed on all sides, thus densifying or compressing the metal by the wedging action of the rolls, and this densifying or compressing action of the rolls upon the metal aids in solidifying or setting the molten metal, as well as to greatly improve the quality of the steel or metal bar produced. The compressing and rolling action of the rolls upon the fluid or setting stream of metal passing between the rolls also tends to give the metal bar a superior texture, grain, or fiber, and thereby to increase the strength of the bar produced.

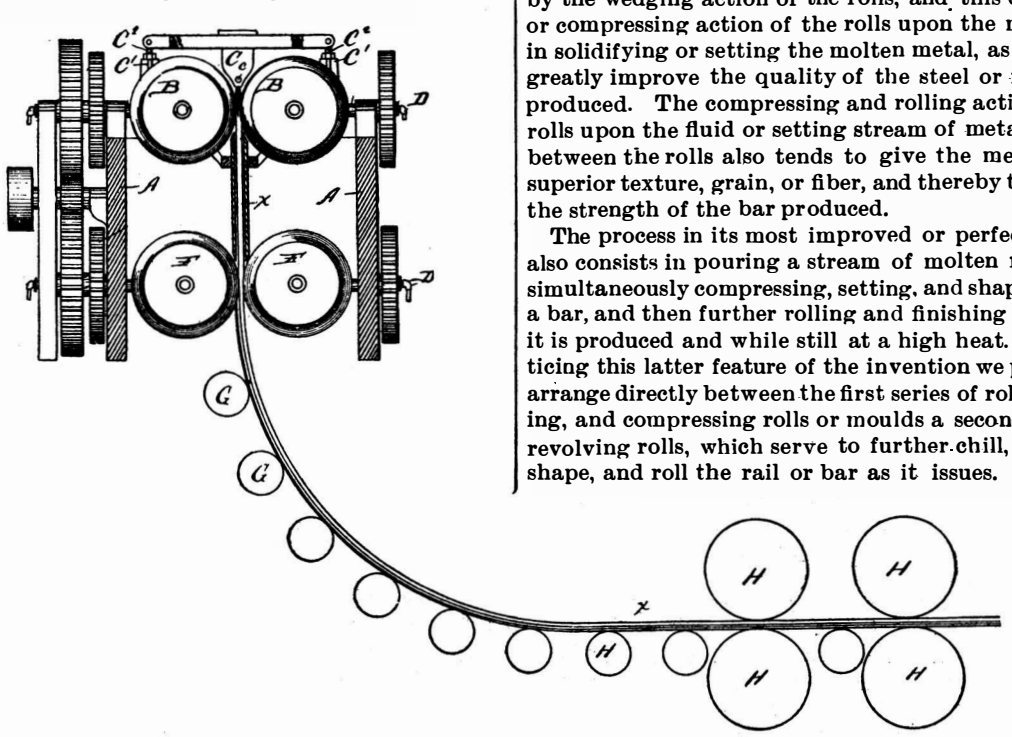
The process in its most improved or perfected form also consists in pouring a stream of molten metal and simultaneously compressing, setting, and shaping it into a bar, and then further rolling and finishing the bar as it is produced and while still at a high heat. In practicing this latter feature of the invention we preferably arrange directly between the first series of rolling, chilling, and compressing rolls or moulds a second series of revolving rolls, which serve to further chill, compress, shape, and roll the rail or bar as it issues. The continuous rail or bar produced is delivered from this second series of rolls by an intermediate curved passage or conveyer, consisting, preferably, of a series of rolls arranged in a curve. As the rail or bar is conveyed out horizontally, it may, while still hot, be passed through finishing and straightening rolls and further rolled to a greater or less extent, as may be desired.

A represents the frame of the machine, on which is journaled a series of rolls, B, preferably four in number, revolving together and having their peripheries shaped or grooved to form a passage or way between them to receive the stream of molten metal as it flows down from the pouring bowl or nozzle, C.

The working or meeting faces or peripheries of the rolls, B, are given a shape or configuration to form an ordinary railroad rail. They may, however, be shaped to give the space or passage any desired cross section, and thus produce a bar of any form required. The rolls, B, have beveled faces, which meet or roll against each other and serve as stops for the several rolls against each other, so that the space or passage for the metal will always be maintained of a uniform size, and thus produce the rail or bar of a uniform cross section throughout. The rolls, B, are each made hollow, and preferably with a central web, and the shafts are also made hollow, so that the water or other cooling fluid or liquid may be made to circulate through each of the rolls for the purpose of keeping them cool or of the desired temperature. The hollow shafts are each furnished with a packing or stuffing box at each end, by which they are connected with the inlet and outlet water pipes, D D'. The pouring bowl or vessel, C, is supported by any suitable means above the rolls, B, during the pouring operation, preferably by standards C', furnished with adjusting screws, C^3. The pouring nozzle, C, is preferably furnished with a valve or device for opening and closing the discharge passage. The hollow shafts of the rolls are all geared together, so that they revolve or roll together at the same surface speed. The gearing employed may preferably be bevel gears, such as indicated at B^3. Two of the shafts, B^2, are also geared together by spur gears, B^4. E is the driving shaft, having a gear, E', which meshes with a gear, E^2, on one of the shafts, B^2. The pouring bowl or nozzle, C, is furnished with a guide or shield, extending down to near the meeting point of the rolls. This is designed to prevent the metal from splattering at the beginning of the pouring operation. A greater or less number of rolls than four may be employed.

F represents a second series of rolls arranged, preferably, directly below the chilling rolls, B, and between which the bar, x, passes as it issues from the chilling rolls, B. Rolls, F, are preferably of the same form and construction as the rolls, B, being hollow and having the same connections for passing water through them, so that they may operate as chilling rolls as well as to further roll, compress, and finish the rail or bar produced.

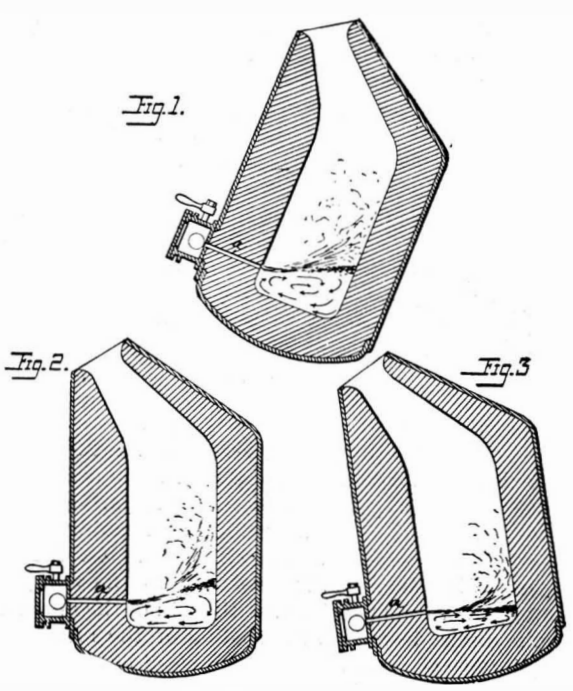
G is a curved guide or conveyer consisting, preferably, of a series of rolls or idle pulley wheels, arranged in a curved path to curve and guide the bar as it issues from the rolls, F, to the horizontal conveyer or series of rolls, H. Some of the rolls, H, are preferably driven and operate to further roll and straighten the rail or bar, as well as to convey it along or away. The curved guide, G, also affords some slack in the rail or bar between the chilling rolls and rolls, H H, to compensate for difference in speed or slipping.



MANUFACTURE OF BARS AND RAILS DIRECT FROM THE MOLTEN METAL.

ROBERT'S NEW PROCESS OF CONVERTING CRUDE IRON INTO MALLEABLE IRON OR STEEL.

The converter, after being charged, is tilted, as shown in Fig. 1, and the blast is applied upon or so near to



THE ROBERT PROCESS.

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the normal surface of the metal in the bath and is so directed thereto that it will not enter or penetrate the body of the metal as in former processes, and so that practically no portion of the metal will be above the blast, and in such manner that only a small portion of the metal will be subjected to the action of the blast at any one time. Thus, as the blast passes inward through the tuyere at a point adjacent to the surface of the metal, its rapid forward motion, combined with the tendency to escape upward in the direction of least resistance, gives to the blast and to the portion of metal carried therewith a resultant diagonally upward direction away from the main body of metal, so that small portions only of the metal are thus acted upon and stripped off at one time; but as such small portions are subjected to the impact of the entire blast, a much more violent agitation is imparted thereto by a comparatively light blast than it would be possible to impart to the entire body by a blast of the most powerful character, and as a result of this agitation not only are the particles of impurities separated from the metal, but the latter is so atomized that it is spread or divided into small particles as to present the desired extended surfaces required to effect the speedy and thorough oxidation of all particles. The action of the blast in carrying a portion of the metal to the opposite side of the converter is to pile up the metal at that side, which, together with the impact of the blast on the exterior portion of the body of metal, results in the production of a circulatory or gyratory current in the direction of the arrows, which causes a flow of the metal downward and upward toward the area of violent action, while the metal is prevented from rising above the line of the blast by the impact of the latter, which strips or beats off the particles presented in its path, so that an inclined surface is imparted to the bath at one edge lower and at the other higher than the mouths of the tuyeres. As a result of the more perfect and rapid oxidation from the more thorough admixture of the atoms of air and metal, there is a higher temperature, inasmuch as there is a more complete and uniform conversion, and because, owing to the limited portion of metal acted upon at one time, every portion may be thoroughly oxidized. The temperature of the bath is therefore not only maintained as the result of the action of the blast, but is increased, so that the metal is rendered extremely fluid, thereby facilitating its movements under the action of the blast and preventing its rapid cooling when removed from the converter.

The blast must not be too deep or it will enter into the body of the metal, while on the other hand it must be deep enough to come into sufficiently extensive and intimate contact with the metal to produce the necessary reactions and conversion, or it will escape without producing the desired results; but it must be remembered that the bulk of the metal diminishes during the conversion by reason of the elimination of the impurities. Consequently the level of the surface of the metal falls during the process, and therefore the blast must be varied to maintain its position relatively to the metal. This may be done in various ways, two of which naturally present themselves—first, by bringing the blast down to the metal, and, second, by bringing the metal up to the blast. The former proceeding may be most conveniently accomplished by using a tilting converter and turning it upon its trunnions during the progress of conversion to different positions, as indicated in Figs. 1, 2, and 3, to vary the ferrostatic pressure against the blast as the process continues, or in a fixed coverter, by having the tuyeres movable and dropping them as required. By thus adjusting the relative positions of the blast and metal a continuous supply of new or fresh metal can be brought into the area or zone of conversion in such exactly regulated quantities as will maintain the proportion of the metal acted on relative to the volume of air as is necessary to the production of the best results. The raising of the level of the metal could be effected by adding more metal or by means of a false bottom, which would raise the whole of the metal, or otherwise, so as by occupying part of the space previously occupied by the metal to restore the surface level.

By tilting the converter or otherwise varying the amount of metal presented to the action of the blast, the extent to which the metal is divided or atomized may be regulated at the will of the operator, and by thus throwing the iron by a regulated action into a sort of spray, or minutely subdividing or atomizing it, the largest possible surface is presented to the atmosphere, and the particles of carbon, silicon, and phosphorus, or other combustible matter, are exposed and commingled with the oxidizing agent, and there is a rapid and intense combustion of said combustible elements and such a high temperature is imparted to the metal as renders it extremely fluid and mobile. The extent of the spraying action will depend on the extent to which the metal is presented to the spraying means. As this is regulated at the will of the operator by the means described, the feeding of the metal, the rapidity of the conversion and degree of heat, and the degree of the fluidity of the metal may all be controlled.

INAUGURATION OF THE STATUE OF LEVERRIER.

The statue raised to the memory of the eminent astronomer Leverrier was inaugurated on the 27th of June, in the court of honor of the observatory.

The Minister of Public Instruction and of the Fine Arts, after being received by Admiral Mouchez, director of the observatory, took his place under the tent raised opposite the monument. Among the distinguished spectators grouped around him were remarked all the notabilities of science. Several addresses were made: first, one by Mr. Fizeau, of the Academy of Sciences, who, addressing himself to the minister, offered through him to the state the monument raised by a national subscription begun by a number of scientists and friends of Leverrier.

Admiral Mouchez afterward thanked the committee, and especially Mr. Fizeau, the active president of it, for the monument.

Mr. Tisserand afterward spoke in the name of the Bureau of Longitudes, and finally Mr. Bertrand, perpetual secretary of the Academy, made the apology of Leverrier.

Mr. Fallieres, in a few words, responded to the eloquent and precise discourse of Mr. Bertrand, and, after this, delegations from all the academies and all of Paris' scientists came to salute the minister and the director of the observatory.

The beautiful statue, which stands on the avenue that leads to the central pavilion, is the work of Mr. Chapu. Leverrier is represented standing, with a celestial sphere in front of him. Upon the pedestal, which is of some little height, is engraved the following inscription:

U. J. J. LEVERRIER.
1811–1877.

The bass-reliefs sculptured on the stone represent, the one at the left, Astronomy tracing the orbit of the planets; and showing the planet discovered by Leverrier the one at the right, Meteorology, designating, with the hand, the observatory, whence proceed all discoveries.

This beautiful work has already been much remarked at the Salon, where it figured in 1883.—*Le Monde Illustre.*

LEVERRIER.

Urbain Jean Joseph Leverrier was born in St. Lo, March 11, 1811, and died in 1877. After a course of study at the colleges of St. Lo and Louis le Grand, he graduated at the Polytechnic School. Obtaining a place in the tobacco bureau, and finding that that occupation required some knowledge of chemistry, he pursued the latter science at leisure, and, in 1837, published two memoirs on the combination of phosphorus with oxygen and hydrogen. Mathematics, however, became the principal object of his study, and from his proficiency therein he soon obtained a minor appointment in the Polytechnic School. From this time on he directed his studies toward the elucidation of the highest problems in speculative astronomy, investigating, especially, the irregularities manifested in the course of the heavenly bodies.

Two memoirs on this subject, presented to the Academy of Sciences in 1839, attracted the attention of Arago, who, becoming his friend, induced him to study closely the orbit of Mercury and its perturbations. In 1844, he presented two important papers on comets to the Academy, and the importance of these contributions to science caused him to be elected to the astronomical section of that body. The success that had attended his calculations of the course of Mercury induced him to revise the still more imperfect tables of Uranus. After a thorough study of the subject, he became convinced that the movements of the latter planet could not be explained by the attraction of any known bodies, and he therefore sought further for the cause of its perturbations. At length, on June 1, 1846, he indicated to the Academy, within ten degrees, the place where a new planet might be seen January 1, 1847. This was, in fact, seen by the German astronomer Galle four months before the time indicated, viz., on September 23, 1846. Leverrier had erred, but by a difference of only two degrees.

This discovery caused an immense sensation, and Leverrier received abundant honor. Most of the learned societies of Europe inscribed his name on their lists; the King of Denmark sent him the Order of Dannebrog; Salraudy, the Minister of Public Instruction in France, had his bust erected in public with great ceremony; Arago declared that the new planet should be called Leverrier; a chair of mathematical astronomy was created for him in the Faculty of Sciences; the Royal Society of England sent him the Copley gold medal; and the Grand Duke of Tuscany sent him a splendid bound copy of the works of Galileo. The planet bore the name of Leverrier for but a short time, that of Neptune being subsequently bestowed on it.

In 1848, Leverrier made some ineffectual efforts to become distinguished as a democratic leader, but it was not till 1849 that he was elected to the legislative assembly from La Manche. Modifying his liberal views, he devoted himself to questions of public instruction and laws relative to scientific discovery. Upon a division of the parties in the Assembly, he joined the Imperialists. After the *coup d'etat*, in 1857, he became senator, and subsequently inspector-general of public instruction. In 1849–50 he read to the Academy the result of his new investigations into the movements of the planets, and in 1853 he presented to the same body tables of the sun's rotation, with the complete system of the small planets situated between Mars and Mercury.

On the death of Arago, in 1853, Leverrier succeeded to the title and authority of director of the observatory. In 1859 he communicated to the Academy a movement of the perihelion of Mercury, which could only be accounted for by supposing another planet, or a series of small bodies, moving between it and the sun. This brought out Dr. Lescarbault's assertion of his discovery of a planet in 1859, and which he named Vulcan. Subsequent researches, however, have failed to establish the existence of such a planet. In 1870 Leverrier withdrew from the office of director of the observatory, and was succeeded by Delaunay; but the latter having lost his life by drowning, Leverrier was reappointed in 1872.

During the Franco-German war Leverrier offered his services to the Government of National Defense, which employed him in perfecting a system of optical telegraphy which he had invented, and which was intended to render communication possible with Rouen or Orleans by using the light of the sun reflected from a mirror, and astronomical telescopes sweeping the horizon in a given direction. The illustrious astronomer succeeded, after a few months, in devising a complete system, but the Prussian invasion had driven the French forces to such a distance that the curve of the earth opposed an insurmountable barrier to the working of the signals. This system was afterward presented to the Academy, and has since been used with great success by the British army in Afghanistan and Central Africa.

One of the creations of the latter days of the great French astronomer was the system of transmitting the hour by electricity, so as to obtain a uniformity of time in public clocks.

A Warning for the Bathing Season.

A writer in one of our contemporaries, in summing up the causes for so many bathing accidents, concludes that most of them are mainly or entirely personal, and so far preventable. Chief among these, we need hardly say, is cramp. To a large extent this is practically identical with fatigue, for it is not the fresh and vigorous muscle which most readily passes into spasm. It is that which is wearied with over-action, in which effete products are in excess, nutrition consequently impaired, all molecular changes languid; where, finally, the movement of contraction, once initiated, gives way but slowly, and tends to linger and become tetanic. The numbing influence of cold is another well known obstacle to muscular activity, and for this reason it is not as a rule advisable to remain more than a few minutes in the water. Malnutrition of muscles is a factor which ought not to be forgotten. It supplies a reason why bathing very soon after a meal is not advisable, much of the blood required for muscular exertion being then diverted to the digestive organs. So likewise must it impose a check upon the rashness of those, adult and youth alike, who after a period of town life, with little physical exercise, find themselves at the coast, and insist on trying whether with jaded energies they cannot safely accomplish feats of swimming. Yet one more caution. This is that every bather should know the state of tide, the currents, and the ground. Unless he is thus careful, he may find himself at any time confronted by unexpected dangers, the end of which it is impossible to foresee. It may seem ridiculous to urge that only those who really can swim should bathe in deep water, yet neglect of even this precaution is by no means uncommon.

A Water Spray Electrical Influence Machine.

At a recent meeting of the Physical Society, London, the above instrument was described by Mr. George Fuller. The apparatus is made up of four similar sections, each consisting of a nozzle, a metal ring, and a metal dish or receiver, arranged about a vertical axis. Pressure water issues from perforations 1-100 in. in diameter in the nozzles, and passes through the rings into the insulated receiver below. The rings are placed at such a distance below the nozzles as to be about the point where the streams break into spray, and the receivers empty themselves automatically. Calling the consecutive sections 1, 2, 3, 4, respectively, the rings of 1 and 3 are connected to the receiver of 4, and those of 2 and 4 to the receiver of 1. The discharge points are connected with the receiver 2 and 3, and a rapid succession of sparks passes when the water is turned on. Professor S. P. Thompson inquired whether the length of the spark was limited by leakage along the glass rods or by the spray passing between the receivers, and in reply Mr. Fuller said he thought the former leakage the most important.

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Correspondence.

Hotter in Utah than in Siberia.

To the Editor of the Scientific American:

In your issue of July 20 there appeared an article headed, "The Great Heat of Siberia," wherein you state that, according to the report of Mr. Geo. Kennan, it is, in summer time, "about as hot a country as there is on the face of the globe." And in his report Mr. K. states the temperature to have varied "day after day from 90° to 103° in the shade."

I thought I would take this opportunity to inform you, and through you the public, that Americans need not go to either Africa or Siberia in order to see the thermometer climb up to 103° in the shade. For if this is the maximum temperature of those countries, they cannot begin "to hold a candle" to either Southern Utah or Arizona. It was only yesterday when in this "Dixie" land of ours (as a portion of Southern Utah is called) we enjoyed the comfortable or uncomfortable temperature of 113° in the shade of a great tree and in a free draught (according to Signal Service instructions and according to a Signal Service thermometer). During the month of June this same thermometer registered a temperature varying from 83° to 107° and an average of 101½°.

During the present month, as far as it has gone, it registered from 91° to 113°.

During the last ten days it stood as follows:

July 18	100½°	July 23	103°
" 19	103°	" 24	104°
" 20	107°	" 25	107°
" 21	105°	" 26	112°
" 22	106°	" 27	113°

Maximum temperature by Signal Service thermometer.

Last evening, at 6 o'clock, I laid my own thermometer out in the sunlight for experiment, and it went up to 130°, while it indicated 102° during the whole afternoon in my rooms.

To-day I again laid it out in the sunshine at 2 o'clock in the afternoon, when it went up to 162°. The metal portion of the thermometer, which is designed to protect the bulb, but does not touch it, was hot enough to burn one's fingers, and so is every piece of metal which is left out in the sunshine any length of time. This latter instrument is a confectioner's thermometer, and will register 400°, and is laid in wood.

It is true that the present season has been the hottest by three degrees for several years, and by at least one degree for many years past; but when this place was first settled 119° to 120° was the usual midsummer heat, so I am told. This latter temperature may be found to-day in Fort Yuma, Arizona, and on some of the deserts between there and here the temperature generally runs up to 124° in the shade and higher, so I am informed. But in spite of all this heat a case of sunstroke was never heard of in this region of the country. Several people have perished on the above mentioned deserts for want of water, but in the settlements nobody is ever very seriously inconvenienced, although a good many *think* they are suffering terribly from the heat. This uncomfortable feeling is, however, mostly due to fat pork, grease, butter, and similar blood-heating articles of food. This place (St. George) is situated in a valley about one thousand meters above the level of the sea. All fruits and vegetables in A 1 condition, and grapes are two weeks ahead of other years.

HERMANN FASCHER.

St. George, Utah, July 28, 1889.

P. S.—Thermometer at Signal Service station to-day went up to 115¼°. H. F.

A Simple Relief for Lung Troubles.

It has long been known that pine needle pillows would alleviate persons afflicted with lung troubles, and a Florida editor relates an incident in support of the fact as follows: During a visit to the home of a most estimable lady living on Indian River, this editor was told of a discovery that had been made which may prove a boon to sufferers from lung or bronchial troubles. This lady having heard that there was peculiar virtue in a pillow made from pine straw, and having none of that material at hand, made one from fine, soft, pine shavings, and had the pleasure of noting immediate benefit. Soon all the members of the household had pine shavings pillows, and it was noticed that all coughs, asthmatic or bronchial troubles abated at once after sleeping a few nights on these pillows. An invalid suffering with lung trouble derived much benefit from sleeping upon a mattress made from pine shavings. The material is cheap and makes a very pleasant and comfortable mattress, the odor of the pine permeating the entire room and absorbing or dispelling all unpleasant odors.

The best builders keep on file the Architects and Builders Edition of the "Scientific American." It enables a person about to build to select from the engravings the style of house suiting his fancy and purse.

Artificial Silk.

Science and industry are ever combining to copy nature, and even dare to attempt improvements on her processes. The Champ de Mars contains many illustrations of this; but perhaps the boldest and most curious attempt of this kind is to be seen in the manufacture of artificial silk. Near the end of the Machinery Hall, that end by the Avenue du Suffren, and quite close to the elevator which raises passengers to the traveling bridges, there is an exhibit showing the manufacture of silk without any aid from silkworms, and on a system which appears to be entirely novel and is certainly of wonderful simplicity. The silk industry has seen great vicissitudes and has had to suffer many cruel troubles from disease, both of the worms and of the trees they feed upon, but up to the present we believe that it has been spared the struggles of competition. If this new process should prove to be what it promises, a new and dangerous rival to the silk trade will have to be reckoned with.

The composition of silk may be briefly described as follows: It is a relatively strong, brilliant material, the produce of the digestive juices of the worm acting on the leaves of the mulberry that constitute its food. The cellulose of the leaf is triturated by the worm and transformed by its special organism into a peculiar substance, transparent, and somewhat resembling horn. This is called kerotine, and it fills two glands, from which it exudes in the form of two threads, which unite as soon as they leave the body of the worm; but this material no longer possesses the chemical composition of cellulose. It is largely combined with a new element characteristic of animal tissues—nitrogen. The silk fiber thus discharged forms a continuous thread, which often reaches the great length of 350 meters, the diameter of the fiber being only eighteen thousandths of a millimeter.

It was reserved for the present generation of inventors to devise a means of imitating by science the mechanical and chemical functions of the silkworm.

An old student of the Ecole Polytechnique, M. Le Comte de Chardonnet, set himself some time ago to try and solve the problem. He took as his material pure cellulose, a material, as we have seen, entirely different to that of which natural silk is composed. Cellulose is, as is well known, the basis of vegetable tissues, and particularly of wood; thus all soft woods appeared to be well adapted for the purpose, in fact, any material suitable for the production of a good quality of paper, white wood, cotton waste, etc., appeared fitted for the production of artificial silk; paper pulp is, in fact, the starting point of the industry. This first operation to which the pulp is subjected is that of nitration, which transforms it into pyroxile; this is done by steeping the pulp in a perfectly defined mixture of sulphuric acid and nitric acid. After thorough washing and drying, the nitrated cellulose is formed into collodion by dissolving it in a mixture of 38 parts of ether and 42 parts of alcohol. The collodion thus made is drawn into fiber by the mechanical means which we shall describe presently; but the thread requires further and very important preparation. The fiber, as it issues from the apparatus that imitates the glands of the silkworm, is one of the most inflammable of substances, and in that state would be absoluely useless. An absolute process of denitration is therefore a necessity. Of this operation we can say nothing, because it is kept a secret by the inventor. Its object is, of course, to extract from the filament the greater part of the nitric acid that it contains, and it would be curious to know if the nitrogen that does remain after the process is in the same proportion as that contained in natural silk.

However this may be, the thread after treatment ceases to be inflammable to any marked extent, but it may, if desired, be rendered still less liable to burn. After the denitration process the filament becomes gelatinous, and other substances can be incorporated with it. Thus, when in this state, it can be impregnated with incombustible material, such as ammonia phosphate, and it is at this stage that the filament can be dyed to any desired color. This latter operation cannot precede the denitration process, as all the color would be taken out during that operation.

The mode of manufacture is very simple, and in the exhibition three apparatus are shown in operation to the public. The first of these is only a model to illustrate the principle. The chief feature consists of a glass tube reduced at the upper end to a capillary passage. It is through this passage that the filament of collodion is forced out under pressure. As it issues the fiber is in a pasty state, and would have no consistency if it did not consolidate immediately. This solidification is secured by means of a second glass tube, which surrounds the first one and extends beyond it. Connected to it is a small pipe which supplies a current of water that bathes the collodion filament and sets it so that it can be secured by pincers and drawn out without breaking; it is afterward led to a spool on which it is wound.

The second apparatus, which is more complete, contains a number of such glass tubes, and illustrates the method by which two or more filaments can be drawn out and twisted so as to form one thread. The third machine is arranged for practical work. The dissolved collodion is contained in a copper receiver, having a capacity of about 15 liters. In this receiver it is subjected to a pressure of from 8 to 10 atmospheres that forces the liquid through a horizontal tube, to which are connected 72 capillary tubes, each with their surrounding water casings. In this manner 72 filaments of artificial silk are produced simultaneously, and these can be spun into threads of various thickness, three such filaments being twisted as a minimum and ten as a maximum. To effect this there is placed parallel to the horizontal tube a rack carrying a series of bronze blades that serve to guide the filaments; the twisted threads are wound upon bobbins running on spindles mounted parallel to the horizontal tube. A frame carrying as many pincers as there are capillary tubes can be put in movement by means of a cord, and if any of the threads are broken these pincers take hold of the filament and join up the broken parts. This apparatus is inclosed in a hermetically sealed glass case, through which a current of air is continually forced by means of a fan. This air is warmed to assist in drying the filaments; but it becomes cool at the exit and deposits the vapors of ether and alcohol.

The circulating water, which is employed to harden the filaments, is discharged into a receiver. It contains a large percentage of the volatile products which can be recovered by distillation, and in this way only about 20 per cent of the ether and 10 per cent of the alcohol are lost. One tube can produce from 3 dwt. to 5 dwt. of filaments per hour, or a length of nearly 1¾ miles. The apparatus works continuously, and with but little attention, and if by any chance one of the capillary openings becomes sealed, it can be cleared by applying heat. Under the conditions in which the machine is exhibited at work, the artificial silk can be sold at from 15 fr. to 20 fr. the kilo., while real silk cost from 45 fr. to 120 fr. the kilo. The manufactured product resembles very closely the natural one, it is smooth and brilliant, and the filament has a strength about two-thirds that of silk. Woven into a tissue it appears stronger and less liable to cut, this property being due to the fact that it is not charged with destructive materials which appear to be always used in dying silk, such as zinc or lead. These foreign matters are probably introduced solely for the purpose of weighting the silk; but there is no object for similar adulteration of the artificial product, because the metallic preparations employed cost as much as the collodion thread?

According to M. De Chardonnet, the density of his product lies between that of raw and finished silk. Its resistance to a tensile strain varies from 15 tons to 23 tons per square inch. (Copper breaks under a load of about 18 tons, and iron under 23 tons.) The elasticity is about the same as that of natural silk, and the inventor claims that it has a superior brilliancy. M. De Chardonnet exhibits a number of stuffs woven wholly with the artificial silk, as well as others mixed with natural silk and other textile materials. The results are really very remarkable. Among other objects, he shows a chasuble of artificial silk, which will bear very close examination.

Artificial silk is not yet manufactured on an industrial scale, but it appears that this will very shortly be done, and while it is impossible to foretell with certainty what will be the commercial results of this curious invention, it is impossible to resist the conclusion that it is highly practicable, and that it even contains the elements of great future success.—*Engineering.*

Important Patent Cases Decided.

Two important decisions were lately rendered by Judge Wallace, in the United States Circuit Court. The first was in the famous paper bag patent controversy, involving the right to the patent for the square-bottom paper bags. The Union Paper Bag Company and James M. Waterbury were the litigants, and Judge Wallace decided against Mr. Waterbury. The right to this patent is estimated as next in importance to that of the telephone, and involves over a million of dollars. George Harding and F. F. Chambers represented the plaintiff, and F. H. Betts and A. H. Walker the defendant.

The other decision was against the Third avenue surface road for using the patent of Henry Root for a cable grip without compensation to the patentee. Judge Wallace granted a permanent injunction to Root, restraining the company from using the grip. Frost & Coe were the company's attorneys, and George Harding represented the plaintiff.

Work of Electricity.

There are now in use in the United States more than 5,650 central electric stations for light and power. There are 210,000 arc lights and 2,600,000 incandescent lamps. There were fifty-nine electrical railways in operation in March last, and eighty-six roads in process of construction. The increase of capital in electrical investments during 1888 was nearly $70,000,000. These are very significant figures, and they point unmistakably to the course of future inventions and discoveries.

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THE PALACE OF FOOD PRODUCTS AT THE FRENCH EXHIBITION.

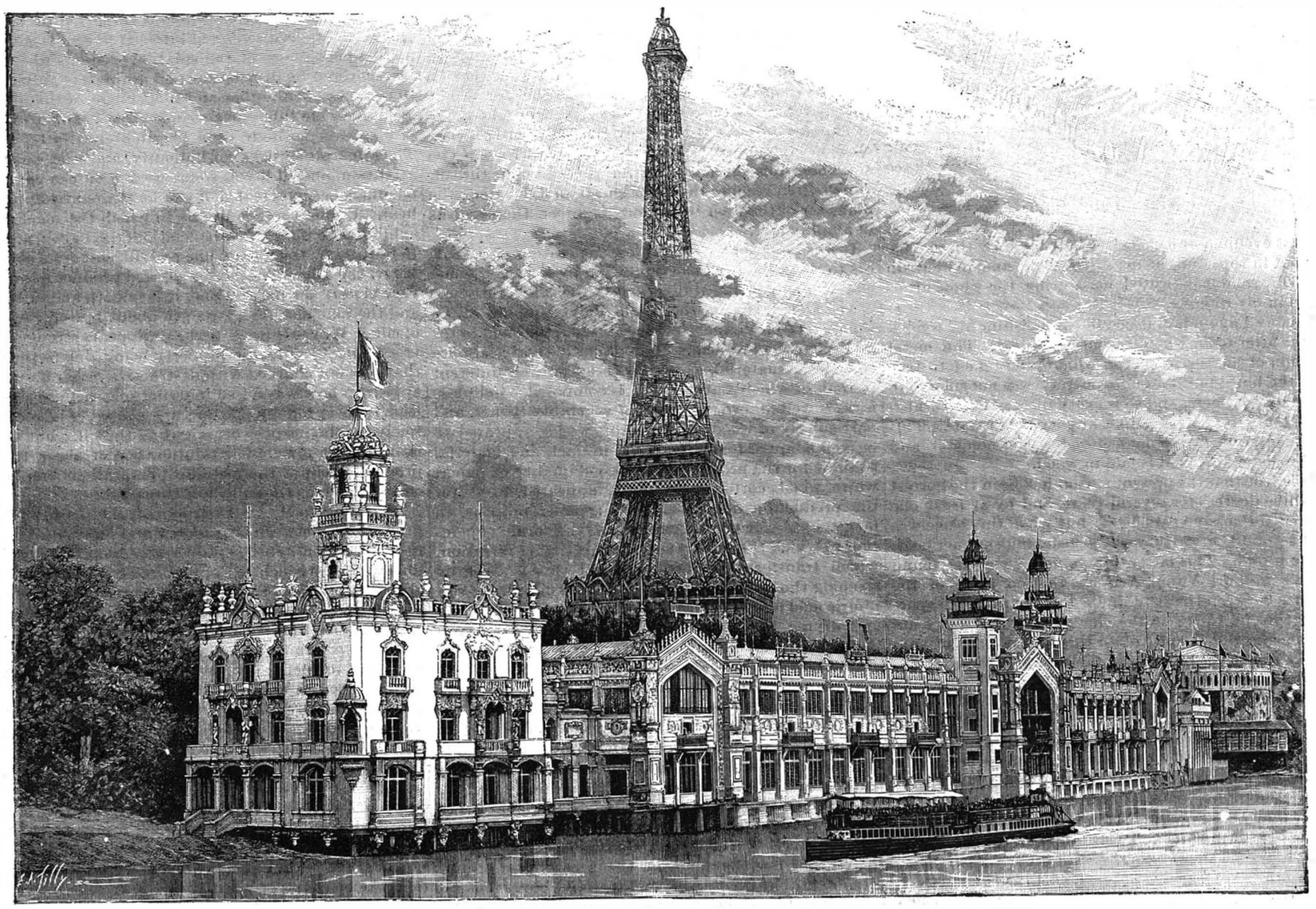
Up to the present, in universal exhibitions or those of less importance, food products have been relegated to unoccupied corners, or placed under tents put up in haste in ephemeral board structures having no pretensions to magnificence.

In 1889 this is all changed. The managers of the exposition, with a true appreciation of the influence that alimentation has upon a people, from a physical as well as an intellectual and a hygienic as well as a moral standpoint, have accorded the *animal* the place that belongs to it.

The fine arts have a palace on the Champ de Mars; and food products, too, have theirs—a true palace, vast, sumptuous, and monumental. The architect in charge of the work, Mr. Baubin, whose unaffected modesty shuns renown and applause, and who, moreover, is one of the most distinguished of his profession, has striven to scatter the "gold dust of his talent" over the work confided to him, and gastronomy will not have to be jealous of its grave neighbors.

The facade of the Gargantua Hotel is charming in its simplicity. Almost on a level with the water, in the basement, are seen wines placed in lines in a hall that preserves the coolness of a cellar. On the first floor, facing the Seine, and on the ground floor of the quay side, extend spacious galleries, in which are brought together all the food products of the world. Three halls, one in the center and two in the wings, are glazed from the flooring up, and are surmounted with cornices in the form of angular frontons that intersect the long line of the entablature. The central *motif* is flanked by two very original turrets, which terminate in openwork belvederes whose elegant outline is coquettishly reflected in the river.

Wooden balconies here and there perforate the wall against which the sashes rest within. The entire sculptural decoration, in the gutter, the frieze, the jamb linings, the brackets, and the pilasters, recall the divinity of this cathedral erected to gluttony.—*L'Illustration.*



THE FRENCH EXHIBITION—THE PALACE OF ALIMENTARY PRODUCTS.

Pasteur's Method for Rabies.

Before the Academy of Sciences a paper was lately read by M. L. Pasteur on the prophylactic method as applied to patients after being bitten. In his brief report for the year ending May 1, 1889, the director of the Pasteur Institute announces the treatment of 1,673 subjects, of whom 6 were seized with rabies during and 4 within a fortnight after the process. But 3 only succumbed after the treatment had been completely carried out, making 1 death in 554, or, including all the cases, 1 in 129.

Natural History Notes.

The Larva of the Common Tiger Beetle.—For agility, strength, and ferocity, this larva is a veritable tiger among the insect world. Its body is long and narrow when young, but becomes broader as the larva approaches the pupa state. After each moult its color is a soft creamy white, which in a few hours changes to a dead black, except in the creases and under parts, which remain lighter. When hungry, it is lithe, active, and quick-motioned, jerking, twisting, and throwing its tail up over its back when molested. Its strong jaws, too, are ever as ready to be used in its defense as in procuring food. The specimens observed by me seem to prefer cutworms as an article of diet, the common garden worm being usually chosen. The tiger larva seizes the worm near its head as it lies in its underground retreat. The struggles of the doomed worm—often several times larger than its assailant—throw both combatants to the surface of the ground, where it continues in the vain effort to free itself until it can struggle no longer, the bloodthirsty little tiger burying its jaws deeper and deeper into its victim, until sometimes its whole head and fore legs are hidden. Without loosening its hold it continues to drain the worm until it is gorged and the worm a mere shell, when it leaves what remains of its victim and retires under the damp earth, where it remains inactive until ready to moult.

In one experiment three tiger beetle larvæ, two of them over half an inch long and the other much smaller, were placed in an insect cage containing thirteen cutworms. In two days only three of the worms were left in company with the two larger tigers, the smaller and the ten worms having been killed and devoured by the larger two. The worms were not, however, so completely drained as those I had observed before. Probably the larvæ had selected the choicest parts on account of the plentiful supply. They had visibly increased in size, but not to the extent one might suppose after having had such a feast. The supply of cutworms running short, the stronger larva did not allow his brotherly regard to interfere with his appetite, but fell upon and devoured his weaker companion. I kept him two weeks, during which he ate seventeen worms, nearly all of them larger than himself.

But a fate more terrible than that of the cutworms overtook him at last. He became dormant and prepared to go into the pupal state. For a day or so I had noticed many very small flies around his cage, but did not think of parasites, which was just what these small flies were. The tiger larva shed his larval skin, and while he was in this condition, soft and utterly helpless, the parasites attacked him. The little flies had laid their eggs on him and the myriads of tiny maggots that hatched out of these eggs burrowed into him and literally ate him alive—a cruel ending to a cruel life. When nothing was left of him but a shell, and a very thin shell at that, the maggots pupated, and shortly after came forth tiny, innocent-looking flies, to act over the same tragical drama. Well, such is (insect) life! In the midst of prosperity comes adversity, and *vice versa*.

WALTER A. LYNN.

The American Catalogue.

The United States Commission have earned the distinction, says *Engineering*, of being the last country of importance to publish a catalogue. Although it appears thus tardily it is a very creditable production, being issued as a bound volume of about 250 pages. The map that accompanies the volume has been copied from that issued with the British catalogue. Probably a feeling of delicacy on the part of the American compiler made him hesitate to acknowledge the source, for it is such a very badly executed copy. Nearly 2,000 names of exhibitors are recorded in the index, a large result as to quantity, but somewhat misleading, as appears on analysis. In the groups devoted to works of art there are 255 exhibitors, and some highly creditable pictures have been contributed. Thanks chiefly to Mr. Pickering's efforts the collection in the Machinery Hall is a very high class one, but the Industrial Court appears to be a great disappointment to Americans themselves. At least 700 exhibitors are found in those classes devoted to education, books, printing, etc., and nearly all the objects shown are either current numbers of periodicals, reports or catalogues of publications or of institutions. Current numbers of the *California Cackler*, the catalogue of books in the Young Men's Christian Association library at Meriden, Conn., the file of the *Swarthmore Phœnix*, and even Betsy Ann White's *Three Holes in a Chimney* have more of a local than an international interest, and do not tend to elevate the standard of excellence.

Our contemporary might have added the above forms part of the fun to pay for which Congress appropriated two hundred and fifty thousand dollars cash from the treasury.

Hot Decks in Torpedo Boats.

The steel torpedo boat D lately arrived at Calcutta from England, but it is to be feared one great drawback to her general utility will be her iron or steel decks, which radiate heat copiously. Her chief officer was landed at Kidderpur ill with sunstroke. A few iron decks are coated with India rubber, but it is a poor heat insulator.

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SODOM DAM AND RESERVOIR.

BY HAROLD BROWN, C.E., HYDRAULIC ENGINEER.

An examination of the broken Conemaugh dam by a committee of expert engineers has revealed an earthwork construction which, to all intents, was equal to the duty expected of it as a mere resistance to the quiescent pressure of the impounded waters. Their report has not yet been made, and in the meantime the general public through its spokesman, the newspaper press, has discussed the construction of dams, particularly earthen dams, in terms more forcible and terse than technical, and weighted with much misunderstanding.

Most hydraulic engineers are agreed as to the safety and durability of good earth, homogeneous throughout and properly constructed. The best kind of an earth dam is that which is made of hard compacted gravel with sufficient clayey matter to bind the whole together, coated by puddled clay bands or layers to prevent percolation, and protected on the exposed upstream and down-stream faces by paving, with sufficient slope and thickness to withstand quiescent pressure and wash of rain storms, and high enough above the flow line to exceed the greatest flood known to the locality.

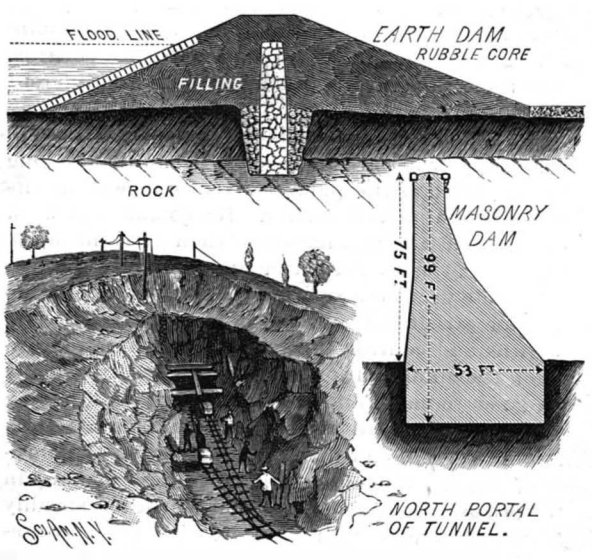
Sometimes the center core of such a dam is a puddled wall, that is, a layer of clay upon clay and gravel, rolled and rammed section after section until the whole is firmly compacted together, and high enough for the duty it is to perform; this forms a tough, elastic mass, impervious to water, possessed of great weight, and when protected from flowing water capable of resistance to a great pressure. It is generally covered by a more porous material, which in its turn is protected by paving blocks laid dry.

One writer of authority says that the cheapest and poorest type of this kind of work is a stone wall 2 to 3 feet thick, with an embankment on each side of it. Such a wall adds nothing to the stability of a dam, but is rather a detriment. Its function is merely to arrest percolation of water and prevent penetration of vermin.

The public is not generally aware that our city authorities are now building a dam that is in some respects similar to a type of dam which is not wholly approved by the best engineering authorities.

In the annexed cut is shown a plan of the east branch reservoir and its connecting tunnel. According to the specifications, Sodom dam is to be built on the east branch of Croton River, to consist of a masonry dam (see section) presenting at its deepest part a height of about 78 feet (exclusive of the foundation below the river bed), a width at base of about 47 feet, and a total length of about 500 feet with a uniform thickness at the top of about 12 feet. A gate house is also to be constructed of masonry, a pipe vault and fountains, with all the connecting pipes, a masonry overflow connected with the masonry dam by an earth embankment, which is to contain a center wall of masonry, a spillway and river walls, and all work necessary to take care of the river water during construction.

The object of the dam is to impound the waters collected by its tributary watershed for storage purposes. The work that is now going forward is of a twofold character, consisting of two dams and two reservoirs, one called Sodom dam reservoir, and Bog Brook reservoir. The storage capacity of Sodom dam and Bog Brook reservoir is estimated at 9,000,000,000 gallons. The two reservoirs are to be connected by a tunnel aqueduct, the approaches are to be made in earth and rock excavation, and are to be finished in masonry. The tunnel is to be lined with brick, and



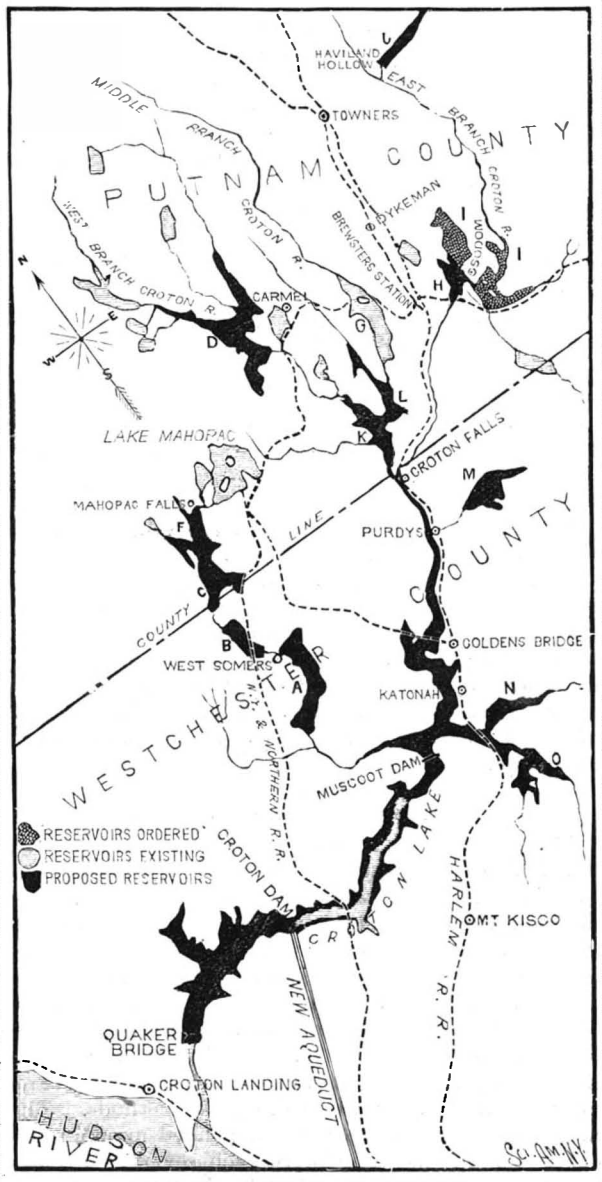
SODOM DAM—DETAILS.

the space between the extrados of the tunnel arch and the line of excavation is to be filled in with suitable material, generally dry rock filling or rubble masonry, according to the nature of the material excavated and the character of the rock roof. The tunnel aqueduct is to be circular in section, about 10 feet in diameter.

Our drawing shows the plan and location of both reservoirs, with Sodom dam and the connecting tunnel.

The north portal of the tunnel is shown in the annexed cut.

It will be observed, upon an inspection of the plan of the dam and its spillway, that advantage has been



MAP OF CROTON RESERVOIRS.

taken of a piece of high ground to locate the spillway upon a course almost parallel to the general course of the river. This necessitates the overflow moving around a salient angle, the union between the spillway bank and the masonry being made by a natural rise of ground forming a frustum of a cone, which is nearly 200 feet wide on top.

The masonry dam seems to be admirably adapted to its purpose. A roadway 12 feet wide runs along its crest the entire length, and also along the top of the spillway embankment. This embankment is described briefly as follows:

After the soil has been removed from the ground forming the base of the embankments, it is grubbed and cleared of all stumps and other perishable matter, and if the material under the soil is not of satisfactory quality, it is to be removed and replaced by other material. By soiling is meant the surface ground, that is the natural sod, or brush or undergrowth, the first layers of loose earth containing roots of grasses or other organic growths. The earth used for the embankments is to be free from stones larger than 3 inches in diameter. All perishable matter to be excluded. The embankments are to be formed in horizontal layers not more than six inches in thickness, thoroughly rolled with heavy grooved rollers wherever practicable, and rammed by hand where the roller cannot reach. Each layer is copiously watered, so that the layers may be kneaded or puddled together. An extra width of twelve inches is to be provided on the slopes, and the surface left is to be dressed smoothly to receive the broken stones that are strewn thickly about to support the final surfacing of paving. The thickness of the paving in the spillway and in the slope walls of the embankment is to be eighteen inches. Each stone will be set solid on the foundation of broken stone or earth, without allowing any interstices. In the river walls large stones are to be used, especially for the face, the walls to be bonded with frequent headers, that is stones running with their longest axes transversely in the wall. Riprap, or large heavy stone loosely piled, may be used in some portions of the work wherever it would not be detrimental to the embankment behind it. After the slopes which are to receive the slope walls have been dressed, a layer, twelve inches thick, of broken stones, is to be spread as a foundation for the paving. The stones used will be two inches or less in their greatest diameter.

Rubble stone masonry is to be used for the side walls of the overflow spillway, for the weir of the overflow and adjoining parts, and for the center wall of the main embankment. This center wall at its greatest width is to be 6 feet through, and at the top 5 feet; this wall is shown in our cross section of the earth embankment of the spillway wall.

This embankment with its wall core of masonry extends some 760 feet in a direct line, at the extreme base about 115 feet in width, with a slope of 2 to 1. If there is any point in the construction that is open to a difference of views and that is likely to be misunderstood, it will be found at this point.

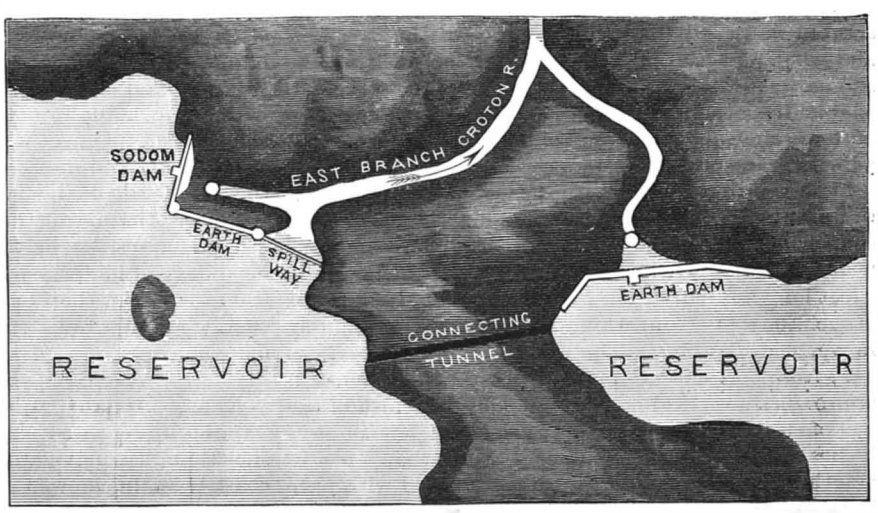
One of our ablest engineers says that whether a given dam should be constructed of earth or masonry will be determined, except for considerations of cost, by the character of the foundation and the available material. If the dam has to rest upon earth, then it should be constructed of that material, unless for some very exceptional reason, as it is much easier to make an impervious union between earth and earth, or between masonry and rock, than between masonry and earth. This will be especially true if the rock foundation does not extend all the way across or up the sides of the valley, as to carry masonry from a rock to an earth foundation without incurring rupture at the point of change is an exceedingly difficult and delicate matter.

If possible, a heart wall of puddle or masonry, as tending, by its lack of homogeneity, to produce unequal settlement and consequent longitudinal cracks, which, by serving to connect partial transverse ones, may lead to more or less serious leakage and possible rupture. Another danger attending the use of a heart wall is that in case the dam is overflowed, the heart wall may prevent the crest from being materially lowered until the back slope is nearly or quite washed away, when the heart wall and the portion of the inner slope supported by it would be liable to give way suddenly and let out with a rush a large portion of the contents of the reservoir at once.

A gravelly clay is the best material for puddle, as, while the clay furnishes the water tightness, the gravel reduces the settlement, and increases the resistance of the clay to washing.

The crest of the spillway is ten feet below the crest of the dam, and accords with the best practice. It is proportioned to carry off the maximum storm flow with a depth of five feet of water, so that the water should never be less than five feet below the crest of the dam.

In the first place, the conclusions from the foregoing premises are arrived at from a long and careful study of the action of water upon impounding structures. In the Sodom dam, the essential resistance of the main body of the storage is met by a masonry wall or curtain which will be described more fully. Advantage is taken of the high ground to locate a waste weir or spillway at one side. The water washes over a well paved embankment, and it is not a question of a direct resistance to a deep body of water that is met by the spillway embankment, but a shallow body of water with a certain ratio of movement. In the direct action of this flow there is a scouring action exerted on the inner face of the embankment, and if the embankment were undermined, it would come from the dynamic rather than static action of the water. In the case of a great flood such action would be positive to a large extent, and to what extent would depend upon the amount of water and the rapidity of its flow. From the direction in which the main body of the water to



SODOM AND BOG BROOK RESERVOIR DAM.

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the spillway runs, it does not seem possible to overthrow the embankment by static action.

In regard to a matter of detail, the heart wall would be of greater service than it now is in holding the embankment together if it were counterforted on both outer and inner face at intervals of 10 or 15 feet, stepping back from bottom to top, for then whatever unit of resistance the wall obtained as a wall would be added to the inertia of the embankment. It will be observed by our cross section that a homogeneous union between the wall and its foundation has been achieved by excavating a bed in the rock upon which to begin the first courses of the heart wall. This is a wise precaution; there is not much evidence, however, of a close union of the earthwork with the masonry core, as the heart wall is battered on both outer and inner face and no rough projections are left for the earthwork to cling to, to increase its own measure of resistance.

The overflow crest is 500 feet in length, and calculations based upon the data of rainfall for this watershed would indicate that length to be sufficient. This is of great importance when it is remembered that in the opinion of some of our most eminent engineers, Conemaugh dam would not have "gone down" had the overflow weir been sufficient to carry off the flood excess.

As to whether the spillway embankment should have been constructed of earth alone, or with a heart wall, there is room for a difference of opinion. From the wording of the specification in regard to this construction, it would appear that the engineers apprehended no lack of good material, for the material necessary to the making of the embankments is to be taken from the wall trenches, from the spillway below the overflow, and from any place within 500 feet of the point where it is to be deposited.

The masonry dam is to be built of sound quarry stone, roughly rectangular, with all irregular and feather edges hammered off. Their beds must be good and present such even surfaces that, when lowering a stone on the level surface prepared to receive it, there can be no doubt that the mortar will fill all spaces. The largest stones are not to measure more than 20 cubic feet, and they are to be used in the proportion of 25 per cent of the whole at most, but they may be omitted partially or entirely if their beds are not satisfactory.

In the annexed cut is shown a sketch of the work now in progress on the masonry dam. The larger stone is loaded on a carrier or trolley, hoisted up to clear the wall, and carried on a 2 inch wire rope and lowered to whatever position desired. The point of view is from the down-stream side of the dam. At the center are shown the outlet pipes that supply the fountains; directly opposite, on the inner face of the dam, the gate house is situated. Its object is to take the water from the lake, where it is received in great masonry chambers and distributed by underground pipes to the fountains. The gate house is developed into a tower which provides a living room for the keeper and a point at which the daily height of the water can be measured and a constant oversight of the entire work be maintained.

The fountains are seven in number, and are an especial feature of this work. From a landscapist's point of view, they will form an attractive center about which is grouped the imposing wall of masonry, with its interesting driveway, the long stretch of swarded bank on the spillway, and the overflow curtain of water making murmurous rhythm to the cadence of the splashing waters of the fountains. While the effect will be of a pleasing character and enlist the admiration of the public, it will also be recognized as essential from a wholly utilitarian point of view. The water passing through the fountains will be thoroughly aerated in its fall to join the waters of the overflow, and whenever needed from this source it will not be stagnant, but living water. Our view of the scene will enable the reader to get a better image of the group of fountains and their surroundings than any word painting can convey.

As shown in our sketch, the masonry of the dam is to be laid on its outer faces in ranged courses. Each course is to be composed of two stretchers and one header alternately, the stretchers not to be less than 3 feet long nor more than 7 feet long, and the headers of each successive course are to alternate approximately in vertical position. The rise of the courses is to vary from bottom to top from 30 inches to 15 inches in approximate vertical progression, and the width of the bed of stretchers is not to be at any point less than 28 inches. The headers are to be not less than 4 feet in length. The face joints are to be pointed with pure Portland cement after the whole structure is completed.

The specifications provide for an optional layer of brickwork on the inner face of the dam. In this work the bricks will be heated to a certain temperature, the mortar to be made of a mixture of Trinidad asphaltum and plaster of Paris. From various experiments which have been made with asphaltum mortars in France, and the results of the examination of asphaltum joints in the remains of Nineveh, there is every reason to believe that a mortar made of rock asphaltum would be more homogeneous and impervious to water than a mixture of plaster of Paris with asphaltum. The shrinkage and expansion of the plaster depends so largely upon the manner of its tempering, and asphaltum is of such an utterly different character, that the union of the two will require more skill than ordinarily falls to the lot of workmen in the construction of dams. It would also appear, from our present knowledge of cements, that to point a wall with pure neat cement when the beds and joints are laid in cement mortar is open to exception; while neat cement alone possesses greater imperviousness than cement with sand, the question of complete adhesion to the stonework and the mortar behind it is of equally vital importance, and there is no doubt of a better joint and surface with a small amount of sand added to the cement than with neat cement alone. These questions of detail have no doubt been carefully considered, and what has seemed best under the circumstances has been adopted. The belief is growing stronger among our engineers that a more frequent use should be made of asphaltum mortar. When properly made and tempered, it is superior in every way for any purpose to lime mortar. Water seems to exert upon it no appreciable solvent action.

While the Sodom dam is one of the minor constructions in the congeries of works that constitute our new system of water supply, and its function is essentially subordinate as a storage basin, there can be no doubt from a study of the many detail drawings which have been carefully made, and the clauses in the specifications which explain these drawings and provide for their proper execution, that it has received an amount of study and research second to no important work ever undertaken for the public.

Radiating Power of Flames.

At a recent meeting of the Berlin Physical Society, Dr. R. Von Helmholtz communicated the results of his experiments on the radiating power of flames. The problem which he had set before himself was to determine the relationship between the radiant energy of flames and the amount of gas consumed for their production. The latter was measured by the fall of the gasometer globe which contained the gas, the former by means of a bolometer, for each of whose scale divisions the equivalent value in heat units had been carefully determined by three different methods. The radiating energy of the flames depended upon a number of conditions which were each severally investigated; as, for instance, the size and shape of the flames, the amount of foreign gases introduced, and the ratio of the amount of oxygen to the amount of gases with which it was mixed. For the purposes of comparative measurements, a moderately high flame was chosen, which produced no smoke and was 6 mm. thick. Luminous flames radiated more energy than non-luminous, and it was proved by an extended series of careful quantitative experiments that the radiating power of the flames was not dependent upon their temperature. From this it follows that Kirchoff's law does not hold good for flames—a result which is, however, quite in accordance with the limitations he put to his law for those cases in which heat is directly converted into radiating energy. In the case of flames it must be borne in mind that chemical affinity comes additionally into play; the speaker entered fully into the influence of this upon the radiation of energy, and endeavored to make it clear by means of an extremely interesting hypothesis. After this he stated the numerical data which he had obtained for both luminous and non-luminous flames, produced with a series of gases—hydrogen, carbonic oxide, methane, coal gas, methyl alcohol, etc. Starting as a basis with Julius' statement that the products of combustion are the only criteria of the amount of radiation, and hence calculating the radiating energy of the flames, he obtained values which corresponded very closely in most cases with those actually observed. Finally he calculated the total useful effect which can be obtained as radiant energy from the gases which are being consumed in the production of the flame. From this he arrived at the interesting result that it is far more economical to use the gases for driving a dynamo which supplies incandescent lamps, and to utilize the energy radiated from the latter, than to burn the gases and utilize the energy which is radiated out from their non-luminous flames.

Height of Great Sea Waves.

Carefully repeated experiments made by an experienced English navigator at Santander, on the north coast of Spain, showed the crest of the sea waves in a prolonged and heavy gale of wind to be 42 feet high; and allowing the same for the depth between the waves, would make a height 84 feet from crest to base. The length from crest to crest was found to be 386 feet. Other estimates of the waves in the South Atlantic during great storms give a height of 50 feet for the crests and 400 feet for length. In the North Sea the height of crest seldom exceeds 10 feet and the length 150 feet.

A New Fire-Proof Non-Conductor for Pipe and Boiler Coverings, etc.

In all non-conductors, the endeavor is to provide as large a number of air cells within a given space as possible, in a material that is itself very light, such materials having been found by experience to best confine the heat. The lightness, porosity, and elasticity of the common sponge, composed as it is of fine flexible, tenacious fibers, interwoven in the form of cells and meshes, constitute the ideal structural qualities for a perfect non-conductor. Taking advantage of this fact, Mr. H. W. Johns, of New York, has succeeded in perfecting a new article of manufacture styled asbesto-sponge, which has been patented in this country and Europe, and has been but recently put on the market by the H. W. Johns Manufacturing Co., in various practical forms, as a non-conductor, notably as a covering for steam pipes and boilers.

The tentacle-like barbs of the sponge, as prepared in the manufacture, are so intertwined with the fine, silky fibers of the asbestos as to make a material at once very elastic and highly porous, while at the same time it is so light that a barrel of it, in the form of filling, barely weighs fifty pounds. And this, too, is effected with the use of so small a percentage of sponge that the material is practically fire-proof. A sample of this filling which was in practical use for several months as a covering for a steam pipe, in which a pressure of 100 lb. was constantly carried, on being taken off and examined showed the same vitality and "spring" which it had when put in place, the sponge portion of the compound not being at all affected, while, of course, it was impossible for the heat to touch the asbestos.

This new material has double the bulk or covering capacity of the same weight of hair felt, and more than three times that of pure asbestos, making its cost, as stated, less than that of any other material employed for similar purposes. It is also supplied in the form of an asbesto-sponge felt and an asbesto-sponge lined felt, furnished in rolls of varying thickness, as well as in an asbesto-sponge cement felting. This latter composition partakes of the nature of a felt and a cement, and is put up dry in barrels to be mixed with water to the consistency of mortar, for applying to steam pipes, boilers, etc., while heated; also coming extensively into use for covering locomotive boilers.

In the manufacture of fireproof asbestos cloth for theater curtains, mittens, aprons, masks, etc., the H. W. Johns Manufacturing Comany has produced goods which have stood the severest tests and proved their efficiency in many emergencies. A case in point was afforded by the recent blowing off of the cap of a tube in a gas well in Canada, it being impossible to extinguish the flame or get near the tube for several days. It was estimated that eleven million feet of gas were being burned every twenty-four hours. The noise from the flame and the danger attending it caused no little excitement, and $1,000 was offered to any one who would extinguish it, which was finally accomplished by a man dressed in asbestos cloth and wearing a cone-shaped mask of the same material. Curtains made of this cloth are now in use in many of the large opera houses and theaters of the country, as a fire-proof barrier between the stage and the auditorium.

The asbestos building felt made by this company has long been well known, and its good qualities are highly appreciated by all of the best builders and architects. This felt was used throughout for floor linings and in partitions in the fine buildings of the Pratt Institute in Brooklyn, and several tons of it have been used in the new Roman Catholic asylum now approaching completion in Manhattanville. It is composed entirely of asbestos, this being absolutely fire-proof, and will not disintegrate by age, is odorless and vermin-proof. It is largely used for lining weather boards, shingle roofs, etc., and is put up in rolls of different thicknesses.

Of all articles of any considerable use that are composed wholly or in part of asbestos, Mr. Johns has long been recognized as the pioneer inventor as well as the most successful manufacturer. He commenced work in this field in 1858, and has since then given his unremitting attention to perfecting and introducing asbestos products wherever such materials could be made useful for structural and mechanical purposes. He now owns and controls upward of one hundred patents on the manipulation and uses of asbestos, many of the goods so made, and now having large sale, having been brought forward as new articles of manufacture. Mr. Johns exercises a controlling interest in the business of the H. W. Johns Manufacturing Company in New York and Brooklyn, a business which has steadily increased in volume, year by year, with the new uses and wider fields which have been found for asbestos materials.

THE *Annals of Hygiene* has discovered there is nothing that so quickly restores tone to exhausted nerves and strength to a weary body as a bath containing an ounce of aqua ammonia to each pail of water. It makes the flesh firm and smooth as marble, and renders the body pure and free from all odor.

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A Criticism of Pasteur's Method.

Dr. Joseph Drzewiecki, physician to the University Clinic at Warsaw, has sent us a paper in which it is contended that the method of anti-rabic inoculation for the prevention of hydrophobia is unscientific. He claims that M. Pasteur has never given a satisfactory answer to the objections urged by Frisch, Ullman, and Peter; and he revives the arguments used by M. Luteaud in the *Journal de Medecine*, which were based on the statistics adduced by Pasteur. He points out that, although the English commission investigated 90 cases, in only 24 of these were the bites inflicted by undoubtedly rabid dogs, so that the number of 8 fatal cases was far in excess of the usual proportion of 5 per cent. Further, that, although according to the report of that commission the total mortality among the 2,682 cases treated by M. Pasteur would ordinarily have been 130 instead of the 40 actually recorded, it should have been stated that only 233 cases were bitten by rabid animals, and that therefore the estimated mortality ought to have been only 15. Both M. Luteaud and M. Peter argued that the Pasteurian method had increased the rate of mortality. The statistics of Dr. Kischensky are then quoted. They were obtained from the archives of the Katharine Hospital at Moscow. From them it appears that, of 307 persons bitten by unquestionably rabid dogs, 18 were bitten in the head (4 deaths), 90 were bitten on the hands (2 deaths), 25 on the feet (no death), and of 170 bitten through the clothes only 1 died. To these may be added 1 fatal case among 4 in whom the site of the bite is not recorded. This gives a total mortality of 2·6 per cent. The mortality among those bitten by rabid wolves (24 cases) was 30 per cent; according to M. Pasteur, it should be 82 per cent. In all the fatal cases the bites were very extensive, and on the head. Of 17 cases bitten by rabid horses, 9 were admitted within three months, but none developed hydrophobia, 1 died from erysipelas and 1 from septicæmia. Of 4 bitten by a rabid hog, none fell ill; there were 4 cases bitten by rabid men, 1 by a white bear, and 1 by a rabid squirrel. Thus, of the total number (396) bitten by rabid animals, 18 died, or 4·52 per cent. Dr. Drzewiecki maintains that Pasteurian inoculation does not prevent hydrophobia in man, and that M. Pasteur only proved that it prevents rabies in the dog, which, however, was not even borne out by the experiments of Frisch. The particulars of some of the fatal cases treated during last year at the Pasteur Institute are cited to support the contention of the inefficacy of the method; and the plea that severe cases of bites on the face or head cannot be successfully treated is held to show that the method is not truly anti-rabic. Again, if the inoculations modify the intensity of the virus, how is it that the symptoms exhibited by the fatal cases are so severe? The method, Dr. Drzewiecki thinks, may be of value to the veterinary surgeon, but applied to man "it is unscientific, and as such must be condemned in the interest of humanity and science."—*Lancet.*

How and When to Drink Water.

According to Dr. Leuf, when water is taken into the full or partly full stomach, it does not mingle with the food, as we are taught, but passes along quickly between the food and lesser curvative toward the pylorus, through which it passes into the intestines. The secretion of mucus by the lining membrane is constant, and during the night a considerable amount accumulates in the stomach; some of its liquid portion is absorbed, and that which remains is thick and tenacious. If food is taken into the stomach when in this condition it becomes coated with this mucus, and the secretion of the gastric juice and its action are delayed. These facts show the value of a goblet of water before breakfast. This washes out the tenacious mucus, and stimulates the gastric glands to secretion. In old and feeble persons water should not be taken cold, but it may be with great advantage taken warm or hot. This removal of the accumulated mucus from the stomach is probably one of the reasons why taking soup at the beginning of a meal has been found so beneficial.

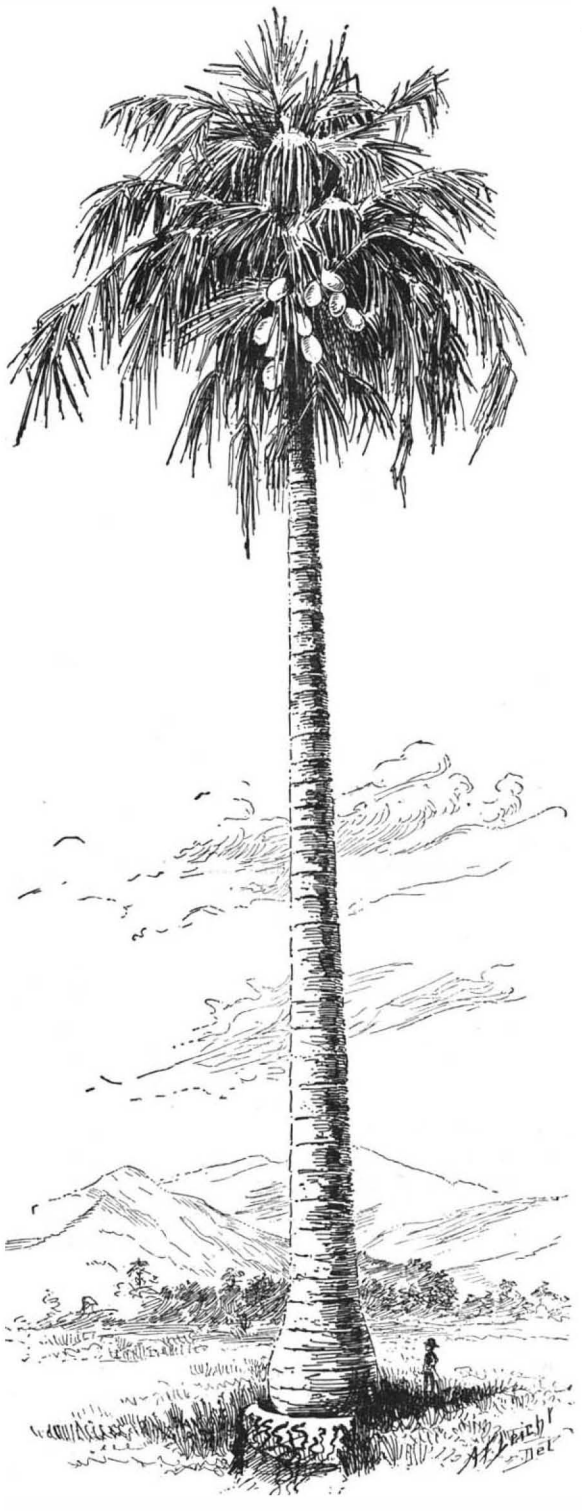
Heart Failure.

"It would be an excellent idea," says the Manchester *Union*, "if physicians of the present day would invent some other reason for about all of the deaths which occur nowadays than the cheap fraud, 'heart failure.' This might not be of serious moment were it not for the fact that hundreds of people are being nearly frightened to death by the constant use of the cause for sudden deaths, and many people who are sick, and necessarily have some heart symptoms, are kept in constant terror by reading or hearing in other ways of death after death by heart failure. There are probably no more deaths from heart failure in these times than heretofore, but a new cause for death has been coined, and the nervous and timid are being severely injured by it." We would suggest that hereafter physicians use the term "cardiac asthenia," which has a learned sound and means just the same. The immediate cause of death in many diseases being, in fact, "heart failure," we do not see how otherwise the "nervous and timid" can be protected.

THE COCO DE MER—LODOICEA SEYCHELLARUM.

BY CHARLES D. BAKER.

On a map the Seychelles group of islands are represented by a dot not larger than a pin head, yet there are thirty of them, and one, Mahe, is eighteen miles long and from three to five miles broad. They lie nearly in the Indian Ocean and just south of the equator, 3° 40′–5° 35′ S. lat. and 55° 15′–56° 0′ E. long. These islands abound with interesting subjects to the student in natural science, but among them none is more wounderful or striking than that famous tree, the Coco de Mer. Nowhere else in the world can this tree be found except on the islands of this group. At one time Curieuse and Praslin were covered with the trees, but travelers who have recently visited the islands say that the vegetable wonder has vanished from the first, but is plentiful on the second. One of these explorers was Col. Nicholas Pike, for seven years United States



THE COCO DE MER—LODOICEA SEYCHELLARUM.

consul at the island of Mauritius, which is nine hundred miles distant, and to which colony the Seychelles group belongs. In describing his impressions of the tree, he says: "The first appearance of the curious Coco de Mer is disappointing, and at a distance looks quite disreputable for so famous a tree. Imagine a tall thin stem towering up over a hundred feet, with a great ragged head of green and withered leaves. The impression is not favorable, a common cocoanut tree is handsomer. These, however, are the male trees; the females are rarely over 60 or 70 feet, and not being so high, are less exposed to the winds. When about twenty or twenty-five years old, before the stems begin to rise, it is certainly one of the loveliest productions of the vegetable world, and here it is seen in all its beauty."

The leaves of the Coco de Mer are winged and palmated, and when the stem is just rising above the ground, in favorable situations, they attain a length of fifteen feet exclusive of the petiole, which is of an equal length and 12 feet wide, but both diminish in size as the trunk increases in height. This is a necessity, as the tall thin stem could not support a head of such large leaves and the heavy fruit which the tree bears. Travelers often give the natives small sums of money, for which they will climb the trees and swing upon the great leaves—a feat attended with much danger, considering the great height of the leaves from the ground.

Before the leaves unfold they are covered with a thick cottony substance, which is used for mattresses. When about thirty-five years old, the tree begins to blossom. After three years from fecundation, the fruit has attained its full size and is called *Coco tendre.* It can be cut with a knife in this stage, but gradually becomes hard and black, but it is seven or eight years from time of fecundation before it is ready to fall. The double nut, with the husk around it and when fully developed, is about the size of a bushel basket. The meat of the nut is agreeable eating, and tastes like the cream of charlotte russe. The shell of the nut is used by the natives for scoop buckets, and is put to a variety of other uses. These immense nuts used to be found floating in the Indian Ocean, and gave rise to any number of fabulous stories in regard to their origin. It was claimed by many that they grew in the sea, but this claim, of course, was easily refuted; but nevertheless, this peculiarity is kept in remembrance by the name which the tree bears, Coco de Mer, or cocoanut of the sea.

When the nut falls to the ground, the first act in the future tree's life is perhaps as wonderful as anything in its future history. It takes nine months after planting before the germ is ready to start, when it shoots out from the nut and creeps along the ground, drawing nutriment from the ground as it goes. When a distance of some twenty feet has been covered, it begins to shoot upward and to put forth leaves, each leaf requiring a year's elaboration in sun and air before the next appears. If the nut does not fall germ downward and meet the ground so as to draw substance from it, after an ineffectual struggle for some few feet on the surface all vitality is exhausted, and the vegetable baby dies from the heat of the sun and the lack of moisture. Another remarkable fact regarding the Coco de Mer is that it rests in a perforated bowl which in form resembles a colander. A great number of rootlets radiate from the trunk and run through the holes in the bowl and then extend into the earth, sometimes for thirty feet. When violent winds blow, as they frequently do in this region, the tree, being tall and slender, with a great bunch of very heavy leaves and nuts forming a great bouquet on its top, bends over until it seems as if it must fall, but rights itself again, its long roots seeming to act like elastics, which draw it back into position again.

On the island of Curieuse, where there are now no specimens of the Coco de Mer, many of the bowls in which the trees once rested are still found in perfect condition, showing the imperishable nature of the material of which they are composed.

The numerous uses to which the leaves of the Coco de Mer can be adapted has led to the wholesale destruction of trees. The Mahometans use them to weave into praying mats, and they regard them as having a special sanctity. These leaves are very beautiful in their unfurled state, their edges being of a delicate green and the laminæ of a clear pale straw color. Beautiful fans, artificial flowers, hats, ladies' work baskets, and other articles are made from them.

The expanded leaves are also used for thatch, and when folded together and pinned with little skewers of bamboo will hold nearly a bushel of fruit. The petiole is used for palings and often for rafters, being strong and durable. The trunks are split and used for palisades and for boards for the ends of houses, and pieces are hollowed out and used for gutters. They are considered imperishable. It is the opinion of Col. Pike and other investigators that the Coco de Mer is a specimen of antediluvian flora.

The Boulak Museum, Cairo.

The magnificent collection of Egyptian antiquities at the Boulak Museum is now, it appears, in the greatest jeopardy, and, unless the European public raise their voices in protest, a scheme, which will probably prove the ruin of all the more perishable objects, will shortly be carried out. It has been decided by the Egyptian government to remove the collection from Boulak to the palace of Ghizeh.

The palace of Ghizeh is totally unfit for the purposes of a museum. It is one of the numerous palaces built by the Khedive Ismail in the heyday of his extravagance, and, though it must have cost a very large sum of money, it is already in a dilapidated condition. The roof was never properly finished, and admits the rain in every direction, the floors and walls are unsound, and quite incapable of supporting the weight of the collection and of visitors, the lath and plaster cornices and ceilings are cracked and falling to pieces, and no amount of money can render it a suitable building for the exhibition of the objects of art proposed to be placed in it.

Persons contemplating building will find it to their advantage to subscribe for the Architects and Builders Edition of the "Scientific American." $2.50 a year. Single copies 25c.

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RECENTLY PATENTED INVENTIONS.

Mechanical.

SPRING MOTOR. — Ludwig Melchior and George Haas, Wilmington, Del. In a suitable framing is a gear train having a power shaft, spring arms being secured at one end to the framing and extended down on opposite sides of the gear train, while there are cords or connections between the free ends of the spring arms and the power shaft, and guides for the cords, the spring arms being multiplied as desired to increase the power.

MOTOR. — Evander B. Newcomb, Parsons, Kansas. In a suitably constructed frame is a transverse shaft, to which is secured one end of a coiled spring fastened by its outer end to the inside of a barrel mounted to rotate loosely on the shaft, the device being simple and durable, and especially designed to operate light machinery, such as sewing machines, jewelers' lathes, churns, etc.

CIRCULAR KNITTING MACHINE. — Charles E. Bean, Scranton, Pa. This invention covers a machine for controlling a plurality of threads or yarns of different colors, and constructed to automatically supply the different yarns to the needles in a manner to form any desired pattern, in stripes or other styles, in the knitted web, the machine involving a novel construction, combination, and arrangement of parts.

PLUMBERS' SAW.—Robert and Charles McAlpine, Trenton, N. J. This is a saw in which a reciprocating saw blade is held to the stock by an adjustable stop for regulating the extent of movement of the blade beyond the stock, with other special features, whereby pipe connections may be severed quickly and accurately within the narrow space usually available for such work in a plumber's trade.

Electrical.

PUBLIC CLOCK.—Alfred Speer, Passaic, N. J. This is a clock with large dial and mechanism for driving the hands by power applied to their outer extremities, to overcome the resistance of wind, ice, snow, etc., the mechanism being electrically operated by a step by step movement through pawl and ratchet devices acting upon pinions meshing into stationary circular racks.

Agricultural.

CORN OR SORGHUM HARVESTER. — Joseph J. Singley, El Dorado, Kansas. This is a machine to be drawn along the ground when the stalks are guided by adjustable fingers to be cut by the knife and fall upon the bed of the machine, the knife being detachably held between the lower finger and bed, and the stalks being conveniently delivered to the ground at any time when the desired quantity has been cut.

Miscellaneous.

PIPE COUPLING.—William M. Brown, Jr., Sacramento, Cal. This coupling is formed with hollow sections secured to the main steam supply pipes, preferably by a shouldered end projecting into the main pipe, and held by ring clamps having their ends riveted together, being intended mainly for use with railway passenger cars, being adapted for automatic coupling and ready uncoupling.

CAN FILLING MACHINE.—Francis M. Nichols, Chillicothe, Ohio. This machine has a measure carrier with disks, each having tubes or cylinders open at both ends, the tubes of one disk sliding within those of the other, the apparatus providing means for filling cans with measured quantities of corn, tomatoes, etc., the cans being automatically fed forward to receive their intended contents.

TESTING DEVICE FOR COUNTING MECHANISMS.—Paul C. Illgen, Leipsic, Saxony, Germany. Numbered counting disks are operated by a rotating shaft, in connection with a supplementary disk, whereby the accuracy of the number shown on the counting disks may be determined, when, if the figures do not agree, the counting mechanism is proved to be out of order.

REFUSE EJECTOR.—John S. Wallace, Nelsonville, Ohio. This device is specially designed to remove refuse from ocean steamers, coal mines, etc., and consists of a discharge pipe into which projects a steam pipe carrying superheated steam, a refuse feed pipe discharging into the discharge pipe, and a gas pipe also opening therein, by means of which the smoke and gases from the furnace combine with the superheated steam.

PURIFYING IRON.—Nathaniel Booth, Hollidaysburg, Pa. This invention covers a compound for purifying iron in blast and puddling furnaces, the compound consisting of red prussiate of potash, bichromate of potash, bicarbonate of soda, black oxide of manganese, etc., in stated proportions, being designed to eliminate phosphorus, silicon, sulphur, etc., from the metal, and especially applicable to red-short iron, reducing its crystalline character to a fibrous condition.

DOUBLE SULPHATE OF ANTIMONY.—Carl J. E. De Haen, List, near Hanover, Prussia, Germany. This is a process of manufacturing the double salt of fluoride of antimony, consisting in mixing fluoride of antimony and sulphate of ammonia and then evaporating the mixture, for the industrial application of the compound in the dyeing art in lieu of the more expensive tartar emetic.

CRACKER CUTTING DIE. — Carl Herrmann, New York City. This is a die provided with a face built up of removable sections which may be easily renewed when broken by an ordinary workman, and the die may be quickly repaired or partially refaced should it be broken by contact with hard substances in the dough or otherwise.

BICYCLE.—Louis A. Hill, Philadelphia, Pa. This invention relates to spring forks to be used in connection with the wheels of a bicycle or similar machine, and provides means whereby the jolting motion of the wheels when passing over obstructions or a rough road will not be communicated to the rider or to the steering arms or handles.

COVER FOR MILK CANS. — Joseph C. Vail, Maple's Mill, Ill. This cover is made of an upper plate and an under apertured plate separated from the upper plate by spacing strips, the space between the two plates being ventilated, thus providing for the ventilation of the vessel while excluding dust, insects, etc.

KALEIDOSCOPE.—Joseph W. Lovibund, Salisbury, Wilts County, England. In this device, instead of the usual irregularly shaped and variously colored pieces of glass, disks are employed, independently movable by a rolling motion in the field of view, to separately or conjointly produce designs of great variety, which may be infinitely varied and repeated or reproduced at will.

TOY RACE TRACK. — William N. McManus, New York City. In this toy track a real race is simulated by a number of miniature figures carried about a circular race course, and after a number of times round the figures are projected forward by an impulse to the finish line, the invention being an improvement on a former patented invention of the same inventor.

NECKTIE. — Miner W. Bruce, Knox Center, Neb. This tie has two retaining tapes extending from opposite ends of the shield partly encircling the collar, one of the tapes being permanently secured to the shield and the other detachable, both tapes carrying hooks adapted to engage apertures arranged in the sides of the collar.

HOSE SUPPORTER.—Miner W. Bruce, Knox Center, Neb. This supporter consists of an elastic divided band having hooks attached to its ends, a clasp for attachment to the hose also having a hook, while an endless cord is passed around all the hooks and slides freely thereon, any slack in the elastic band of the supporter being automatically taken up by the clasp-carrying cord.

GARTER. — Jacob Katzenberg, New York City. This garter consists of an elastic tape having its ends united by a metal clasp applied to the tape a short distance from its extremities, the ends being left free to form the bow pieces which cover the clasp at the front.

SYRINGE.—Jay W. Kirkwood, Silver Mountain, Idaho. This is a medical syringe having inner and outer chambers connected with each other at or near their rear ends and both having openings through the forward end of the syringe, a piston working within the inner chamber, whereby the syringe operates simultaneously to discharge a medicated fluid and to remove by suction foreign matter.

NEW BOOKS AND PUBLICATIONS.

INCANDESCENT WIRING HAND BOOK. By F. B. Badt. Electrician Publishing Company, Chicago, Ill. 1889. Pp. 66. Price $1.

The practical side of electric wiring, with the electrical arithmetic necessary for "house engineering" is treated of by the author in a clear and succinct style. Numerous illustrations are embodied in the text, and the manual is one that will, we doubt not, be well received by the profession generally. It is a hand book, a code to be always at hand, as well as in the library. The need for a practical discussion of electrical problems is a growing one, and all worthy accessories to the literature of the subject are to be welcomed.

ACADEMY ARCHITECTURE AND ARCHITECTURAL REVIEW. Quarto pamphlet. Pp. 102. Edited and published by Alex. Koch and C. W. English, Chancery Lane, W. C., London, England. Wm. Mueller, New York. Price $2.50.

We are informed that the European edition met with so much success that the London publishers decided to issue an American edition. Every page contains one or more plates of buildings, bits of detail or architectural sketches from an English point of view without any descriptive text. The work is arranged in two parts, the first containing miniature reproductions of designs, studies and sketches of architectural work that were exhibited at this year's academy exhibition, and the second part, designs of notable buildings executed within the last five years, confined however to European work. The most notable work at the Academy is reproduced, particularly an interior view of Mr. E. R. Robson's People's Palace reading room. Mr. D'Oyly Carte's new theater in Cambridge Circus by T. E. Colcutt, the famous Hotel Metropole at Brighton, in Mr. Waterhouse's best style, also a chapel in Duke Street, Mayfair, by him, interesting from the massive yet graceful treatment of the spire. The most charming bit in the whole work is a water color sketch of a Norman gateway and library at Windsor Castle, by Phene Spiers, the famous teacher of drawing. The frontispiece is the chef d'œuvre of the English work, viz., the Brownlow Street front of University College, Liverpool, by Mr. Waterhouse. Sir Arthur Blomfield contributes a beautiful sketch of a reredos for new Church of St. Mary, Portsea. The chief works of interest in the second part are the several drawings of the Hofburg Theater, Vienna. A study of the various features of the design is full of interest. It marks the monumental feeling better than any other design exhibited. The point of view taken for the perspective does not do the noble front justice. The horizon line is too high. The elevations are much more satisfactory to one accustomed to interpret them. The publishers announce their intention to continue this work by an annual number. We wish them every possible success. The plates are excellent. More than that, there is not a poorly drawn sketch in the collection, and for one who desires to carefully study English work, no better opportunity could be found. The only regret we have to record is the evident lack of space for more sketches of plans, bits of detail, and reproductions of water color studies, such as the beautiful work shown by Messrs. Blomfield and Phene Spiers. If English plans could have American elevations and groupings, or American elevations and feeling for contrasts could have English planning, modern architecture would be worthy of the closest study and highest praise.

L'ART D'EMPAILLER LES PETITS ANIMAUX. By Paul Combes. Librairie de la Science en Famille. No. 118 Rue d'Askes, Paris, France. This is a little pamphlet of 32 pages on the methods of mounting animals.

LA PHOTOGRAPHIE ET SES APPLICATION. I. LA FERROTYPIE. Obtention directe des positifs a la chambre noire. By F. Drouin. Librairie de la Science en Famille. Paris, France. Pamphlet of 36 pages.

CONSEILS PRATIQUES AUX AMATEURS D'ELECTRICITE. Piles, sonneries, accumulateurs, allumoirs, appareils de secrete, etc. Par Drouin et Huche. Pamphlet of 46 pages. Librarie de la Science en Famille. Paris, France.

CE QU'ON PEUT FAIRE AVEC LES OEUFS. Collection complete et variee des experience faciles et amusantes pouvant etre executee par tout le monde avec des oeufs. Par Prof. Abel Cepak. Ch. Mendel, Paris, France. Thisis an illustrated paper-covered book of 175 pages on the various tricks and experiments that may be made with eggs.

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SCIENTIFIC AMERICAN BUILDING EDITION.

AUGUST NUMBER.—(No. 46.)

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3. Page engraving of the new and elegant Trinity church at Tiffin, Ohio, designed by F. K. Hewitt, architect.
4. A New England mansion. W. B. Tubby, New York, architect. Perspective elevation and floor plans.
5. Elevation in perspective and floor plans of a cottage at Jersey City Heights. Cost twelve thousand dollars.
6. A cottage recently erected at Bridgeport, Conn., at a cost of two thousand three hundred dollars. Floor plans and perspective.
7. A handsome country residence at Belle Haven Park, Greenwich, Conn. Cost eleven thousand dollars. Perspective and floor plans.
8. A house for eight thousand dollars, recently erected at Bridgeport, Conn. Perspective view and floor plans.
9. The New United States court house and post office, Charleston, S. C. Cost three hundred thousand dollars. Perspective and plans.
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For Sale or Royalty—Baling press, patent No. 406,680, described in SCIENTIFIC AMERICAN, No. 5, Vol. 61. Has great compressing power; light and easy to operate. Meets a long felt want of farmers, broom corn, cotton, and wool growers. Manufacturers on royalty can have a bargain. W. E. Walter, Silver City, Idaho.

The Lowrie toilet stand, illustrated in this paper, May 26, 1888 (no movable bowl or pitcher required), is now on sale in elegantly finished quartered oak, with movable top, by Wm. R. Farrand, Detroit, Mich.

For Sale.—Buckle-patent No. 407,919, July 30, 1889. For description see page 98.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1141) A. G. D.—The outside of a galvanized iron roof has a zinc surface which, being in contact with moist air, is slowly oxidized. The oxide shows as a light white powder which sticks to the hand as you brush it over the surface. Rains wash the oxide into the tank and the water absorbs it to a large degree. This is very noticeable wherever plumbing is done with galvanized pipe. The first water that is drawn after the pipe has been closed over night tastes strongly of zinc. Hence housekeepers are cautioned to always waste as much water as has lain in a galvanized pipe over night. The oxide of zinc is poisonous. The oxide of iron is not poisonous. For this reason we recommend the painting of zinc or galvanized roofs with oxide of iron paint or paint made from pulverized slate or mica. Even a coat of boiled linseed oil will protect the roof from oxidizing. A physician or druggist should be able to advise you as to the effect of using the water from a galvanized roof. Any person using spring water should be able to detect the zinc taste in the water from your roof.

(1142) J. S.—The rule of your council in regard to kind of pipe and fittings is very absurd. The universal practice in the United States for gas fitting is to use black iron pipe, malleable iron fittings,

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tees, and elbows. Bending and offsetting of the pipe is a matter of economy or taste with the pipe fitters. Offsets are generally bent if not too large to insert conveniently. Bends made on ends of small pipes ¼ inch, ⅜ inch, and ½ inch, for terminals for chandelier and bracket connections, are properly used to prevent unscrewing of the short piece through the plastering. These bent pieces have a piece of flat iron or a strap soldered to them so as to anchor the pieces for solid support to the chandeliers and brackets. The licensing and registration of gas fitters and plumbers is a subject of municipal regulation in all large cities.

(1143) O. E. Z. asks: 1. Is not an ampere the current produced by one volt through the resistance of one ohm? If so, how can a dynamo have a capacity of 130 amperes and 100 volts? A. Yes. The capacity of a dynamo in amperes is calculated by dividing the electromotive force by the resistance. 2. What does E. M. F. indicate? A. E. M. F. stands for electromotive force. Electromotive force is the power of the current to overcome resistance. 3. Watt? A. A watt is the unit of electrical power. It is equal to a volt mutiplied into an ampere; 746 watts constitute an electrical horse power.

(1144) G. B. asks (1) information on blue printing and reproduction of drawings. A. We refer you for blue printing, etc., to SCIENTIFIC AMERICAN SUPPLEMENT, No. 584. In other numbers you will find much information on this line of subjects, for which we refer you to our index of papers in SUPPLEMENT. 2. For a good recipe for waterproof, India, or drawing ink. A. For waterproof drawing ink rub up the pigment with a solution of shellac in hot borax solution. This will be nearly waterproof.

(1145) J. M. D. asks: 1. What is the best material to use for a diaphragm in non-electric or an electric telephone? A. For an acoustic telephone used a diaphragm made of wood, pasteboard, sheet iron, or strained parchment. For an electric telephone use an iron diaphragm. 2. Does the material of which a telephone box (or case) is composed have an effect on the sound? A. Probably the box acts to some extent as a resonator, but it has no great effect upon the sound. 3. If so, what is the best material for such use? A. Such wood assounding boards are made of, spruce for example.

(1146) S. J. asks for a chewing gum, having some cereal in its composition. A. Take of balsam tolu 4 ounces white resin 16 ounces, sheep's suet 1½ ounces, more or less of the latter according to the season. Of this preparation take 2 ounces, soften in a water bath and mix in 1 ounce white sugar and 3 ounces oatmeal. Roll portions of proper size in sugar or flour and form in sticks to suit.

(1147) E. B. asks a good recipe for compressed yeast and the length of time it will keep. A. Vienna yeast is said to be thus made: Indian corn, barley, and rye (all sprouting) are powdered and mixed and macerated in water at a temperature from 149° to 167° Fah. Saccharification soon takes place, when the liquid is drawn off so as to be clear, and a very little yeast is added. The yeast forms a thick scum on the surface. It is removed, drained, and pressed in a hydraulic press. It may be removed several times. It will keep from 8 to 15 days.

(1148) E. N. B. asks: 1. Which city furnishes the greatest yearly output of steel rails, St. Louis or Pittsburg? A. Pittsburg. 2. What is the best anthority in chess for amateur players? A. The new edition of chess, by G. H. Gossip, which we can mail for $3. We also refer to numerous SCIENTIFIC AMERICAN SUPPLEMENTS. 3. The address of Herr Steinitz chess monthly. A. *International Chess Magazine*, New York city.

(1149) L. M. P. asks (1) why several seeds, mostly beans and corn, when they are being grub eaten, become notably hot. A. Because the corn is fermenting at the same time, and the slow combustion of fermentation develops sensible heat. 2. A recipe to restore clean and transparent glassware made dim and whitish by a rather long exposure to humidity. I have tried many acids, muriatic among them, and always without success. Scraping is very troublesome. A. Nothing better than scraping or other mechanical polishing will produce the desired effect. Some polishing powders, such as flour of emery, followed by rouge rubbed on with a chamois, might be superior to scraping.

(1150) J. H. K. asks: 1. How can cloth and duck lining be made waterproof, not affecting color or original finish? A. Paraffin melted in with a hot iron is very effectual, and while somewhat changing the appearance, is on the whole about the best application. 2. What is the smallest space in which heat can be generated, not using fire? A. For very intense heat the voltaic arc, where the temperature can be further intensified by the concentration of the sun's rays thereon by a concave mirror or convex lens. The secondary spark due to opening and breaking an electric circuit is extremely small and represents a certain degree of heat

(1151) F. D. M. asks how to clean out the rust from an iron water pipe. My pipe is 800 feet long, three-quarter inch, and is so filled up with rust that the water barely runs through it. A. The pipe cannot be cleaned out without taking it apart and cleaning each piece with a rod. It is not profitable to lay small wrought iron pipe that is not galvanized. It soon rusts and stops up. Galvanized pipe does not rust, and if the water is kept running all the time, it will be safe and free from contamination from the zinc coating.

(1152) G. E. H. asks the best method of soldering automatic sprinklers, the solder being applied to brass or phosphor bronze, and the desire being to make a joint that will not weaken with age and that will only be affected by such a degree of heat as indicates the proximity of fire. A. A solder made 1 part each of tin and lead and 2 parts bismuth, melting at 200° Fah., is usually used for sprinklers. Use soft or white resin or Venice turpentine for flux in soldering. A blow pipe is better than a copper, as the copper is slightly absorbed by the solder, which may change its melting point.

(1153) T. S.—For a description of the new government cruiser Baltimore, see SCIENTIFIC AMERICAN, July 20, 1889. For the theory of the compound engine, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 204.

(1154) R. writes: The purpose of the chip inclosed is to color small articles and especially Easter eggs. It is used by stirring the chip in a cup of hot water until the color is extracted from chip. Then the article is allowed to remain in this water for a few moments. I have seen the following colors prepared in this way: Red, purple, blue, and yellow. How is this composition prepared? A. Dissolve aniline colors of the desired tint in alcohol and mix with a hot solution of gelatine. Dip the chips into this and allow them to dry. You may, while they are still moist, dip them in the dry colors so as to cause some to adhere. You may also substitute gum arabic for gelatine.

(1155) J. H. P. asks: What paper gives full account of comets? A. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 284, 260, 323, 330, 331, 343, 172, 173, 313.

(1156) F. N. asks the price of tin per pound, also if there are any mines in the United States producing tin. A It is about 20 cents per pound. It has been found in Dakota, in the Black Hills, but as yet in comparatively small quantities.

(1157) C. H. G. writes: 1. What is a madstone? Are there any well authenticated cases where hydrophobia has been prevented by applying a madstone to the wound caused by the bite of a mad dog? A. The madstone is a porous stone that acts by capillary attraction to withdraw the venom from a newly made wound. It is doubtless of some effect in such cases. A carbonized deer's horn has been recommended for the purpose.

(1158) L. L. P. asks how sulphur acts to free tin from zinc when sprinkled on the melted alloy? A. The sulphur combines with the zinc, forming sulphide of zinc, which separates from and tends to float upon the melted tin.

(1159) J. K. asks a formula for erasing the white stains that occur in some of the bricks in newly constructed buildings? A. Wash with dilute muriatic acid.

(1160) H. A. Z. asks: Can cast iron be made stronger, and suitable for a small cannon, by the addition of aluminum in ladle, and what proportion would be best? Also, could copper, aluminum, and iron be used for the above? A. One-tenth of one per cent of aluminum mixed with cast iron by placing the required quantity in the ladle before tapping largely increases its strength and solidity; 5 to 10 per cent aluminum with copper makes aluminum bronze, which is nearly as strong as steel. One-tenth of one per cent of tin in cast iron also increases its strength and solidity. Copper is of doubtful effect when mixed with cast iron.

(1161) C. F. R. asks: How many feet fall of water is necessary to obtain a pressure of 25 pounds per square inch? A. 57½ feet is the hydrostatic column of water equal to 25 pounds pressure.

(1162) Amateur writes: Is there any formula or receipe for a mixture into which cardboard, used for outdoor signs, can be immersed, and made superficially, or better still thoroughly, waterproof? A. Heat the cardboard in melted paraffin, as hot as the paper will stand.

(1163) M. R. asks: 1. What does the word feathering mean as applied to the wheels of the new steamer Puritan? A. A feathering wheel has its buckets pinioned to be movable by an arm and connected with an eccentric, so that the buckets dip and leave the water vertically. 2. Is the Redeman-Tilford steel process used in the manufacture of steel plates for steamboat boilers, and if so, where? A. We have no information as to the localities of steel works using the Redeman-Tilford process. Steel plate for boilers is known in the market as Bessemer or open hearth steel. Its individual quality is quoted under certain stamps or the makers' names. 3. Does the United States marine law confine steamboat builders to certain established forms of steam boilers, and so forbid or make impossible novelties or improvements? A. United States marine inspectors have not established special forms for boilers. The regulations relate to quality and strength of material. The inspection of boilers covers also the elements of safety in form. 4. I want to build an arch in a furnace; fire brick and fire clay mortar will not withstand the heat for any time. What material must I use? A. Fire brick and fire clay are used in our hottest furnaces. Use only No. 1 extra brick and fire mortar made with the same kind of brick pulverized mixed with best fire clay. There is great difference in the quality of fire brick on the market.

(1164) W. M. L. asks how much of a resistance coil would be required to reduce a 500 volt current (of the Thomson-Houston) to the right strength for simple electric motor. A. No general rule can be given; try it on a shunt circuit from main line. House connections often act as resistance coils. If the current is of the alternating type, the motor will not work. 2. Would an amalgamated zinc interfere with the current, if a solution of rock salt be used as a solution, with copper as the other pole? A. It will by its resistance, and according to the order of the plates will increase or decrease the electromotive force. 3. Has lightning ever been measured with regard to volts and amperes? A. Not accurately. It is of many thousand volts potential. We do not understand your fourth query.

(1165) J. M. asks (1) how to make the cakes of paint, black and colors, used in stenciling. A. See answer to query No. 1006. 2. How to make a plaster cast of a hand or foot. A. Oil the hand. Provide a soft pillow, and cover it with a towel, and over that a newspaper. The hand is pressed down into this until partly embedded, and the plaster mixed with alum water is poured over it and backed up by a stiffer portion. The hand must be kept perfectly still, of course; in a few minutes the plaster will have set. It is now removed from the hand, the faces smoothed and rubbed with lard, the hand replaced, and a second casting taken of the other side. Owing to the use of the lard, the two will easily separate and will form a complete mould for casting an image in. Oil the mould before using it. It may be made in several pieces. If a man's hand with hair upon it is the object, it should first be shaved. Instead of a pillow, sand may be used for the embedding material. Care must be taken to avoid "undercutting." The foot is an easier object, but little embedding being required for the first casting.

(1166) E. B. writes: 1. I want to dissolve or disintegrate a composition in nature like glass or porcelain which is subjected when fused to great heat—white heat at least; can it be done? A. This can be done by fusing the finely powdered material with carbonate of soda, or more simply by treatment with hydrofluoric acid in a platinum dish. 2. Is there any acid which will attack glass or porcelain? A. Hydrofluoric acid. 3. Can feldspar, after being fused as described, be dissolved? A. By the fusion method or treatment with hydrofluoric acid. 4. What acids will destroy platinum? A. It dissolves in the presence of chlorine. A mixture of 3 parts hydrochloric and 1 part nitric acids is often used for its solution.

(1167) C. E. G. asks: 1. What acid will dissolve platinum? A. See answer to preceding query. 2. What acid will separate platinum from lead? A. To neutral solution of platinum add sulphuric acid, which will precipitate the lead as sulphate, leaving the platinum in solution.

(1168) Courier.—The plant sent for identification is the common plantain, *Plantago major*, L., one of the commonest of weeds.

(1169) R. J. P. asks: At what height do the clouds generally float? A. The height varies from the level of the ground, when they constitute fog or mist, to several miles. As a mean, 1,300 to 1,500 yards in winter and 3,300 to 4,000 yards in summer are given. Gay-Lussac observed clouds over 7,650 yards above the earth.

(1170) M. O. K. asks: What process is best to extract the strength from sage leaf to get it strong and preserve it? A. Distill off the oil by boiling with water and collecting the distillate, separating by decantation the oil from the water.

(1171) J. W. asks for a good receipt for cementing rubber to earthenware or chinaware so that it will stand ordinary rinsing or washing in tepid water. A. Soak strong shellac in ten times its weight of strong ammonia for three or four weeks. This makes a liquid cement, which, however, will not stand much heat. Or try a mixture of 1 part gutta percha with 10 parts asphalt melted together.

(1172) D. L. B. asks for a good formula for aromatic toilet vinegar. A. A number of formulas are given, such as the following:

a. Cologne extract	2 oz.
Alcohol	3 pt.
Acetic acid	½ "
Orange flower water	½ "
b. Extract of cassia	½ pt.
" " violet	½ "
" " rose	½ "
Tincture of orris	½ "
White wine vinegar	2 "

Digest for ten days and filter.

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AND EACH BEARING THAT DATE.

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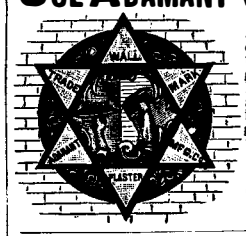

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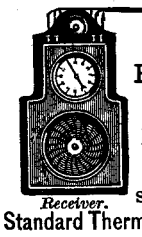

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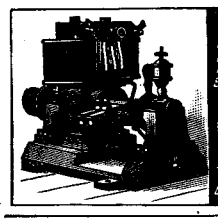

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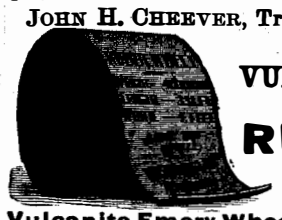

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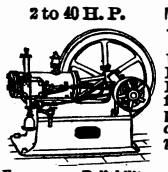

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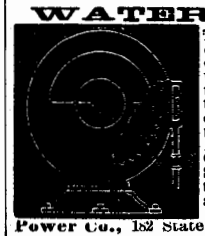

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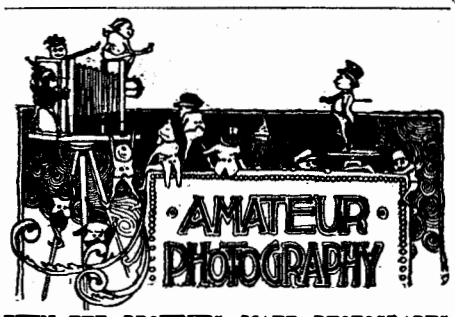

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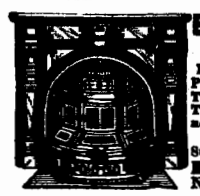

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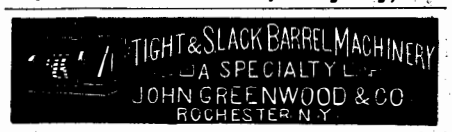

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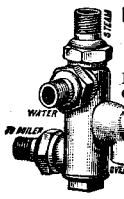

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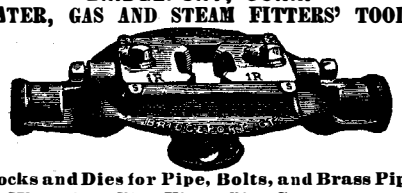

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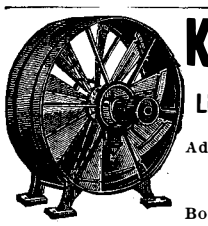

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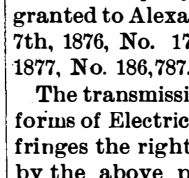

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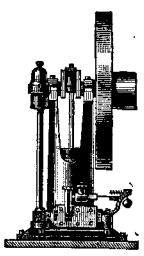

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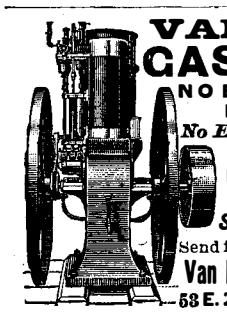

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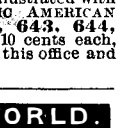

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